



## Workshop Manual FOX 2004 ➤

4-Cyl. injection engine (2 valve Roller Rocker Finger)

Engine ID

BLH

Edition 03.2006





## List of Workshop Manual Repair Groups

### Repair Group

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- 10 - Removing and installing engine
- 13 - Crankshaft group
- 15 - Cylinder head, Valve gear
- 17 - Lubrication
- 19 - Cooling system
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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.





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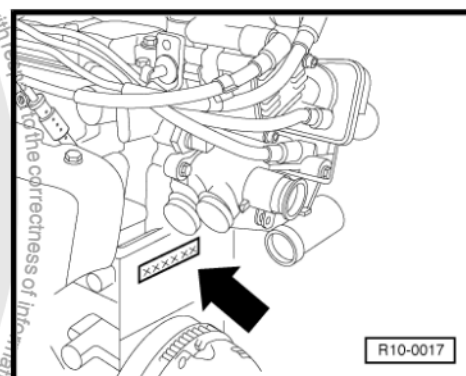
## 00 – Technical data

### 1 Technical data

#### 1.1 Engine number

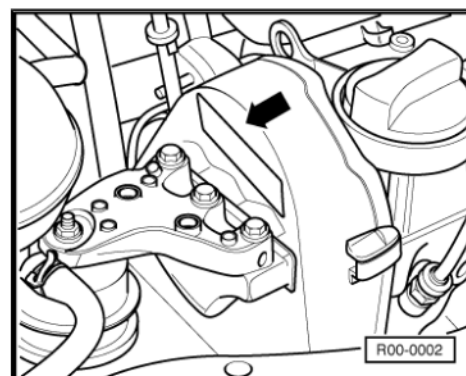
Engine number is formed by up to nine digits (alphanumeric). First part (at most 3 identification letters) represents the "engine identification letters", the second part (6 digits) is the "serial number". If more than 999,999 engines are manufactured under the same identification letters, the first digit of the 6-digit group is replaced by a letter.

Engine number ("identification letters" and "serial number") are on the engine block, under the thermostatic valve body.



Additionally, an adhesive is installed on upper part of mechanical distribution -arrow- with "engine identification letters" and "serial number".

Engine identification letters are also indicated on vehicle data plate.



#### 1.2 Engine features

Engine code letters		BLH
Manufactured		09.03 ➤
Capacity	cm <sup>3</sup>	1599
Output	cv(kW)/rpm	101.0(74.0)/5750
Torque	Nm(mkgf)/rpm	140.0(14.3)/3250
Diameter	Ømm	76.5
Stroke	mm	87.0
Compression rate		10.8:1
Octanage	at least	91 lead free
Injection, ignition		Bosch ME 7.5.10
Knock control		1 knock sensor
Selfdiagnosis		yes
Lambda control		2 probe



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Engine code letters	BLH
Catalyst	yes



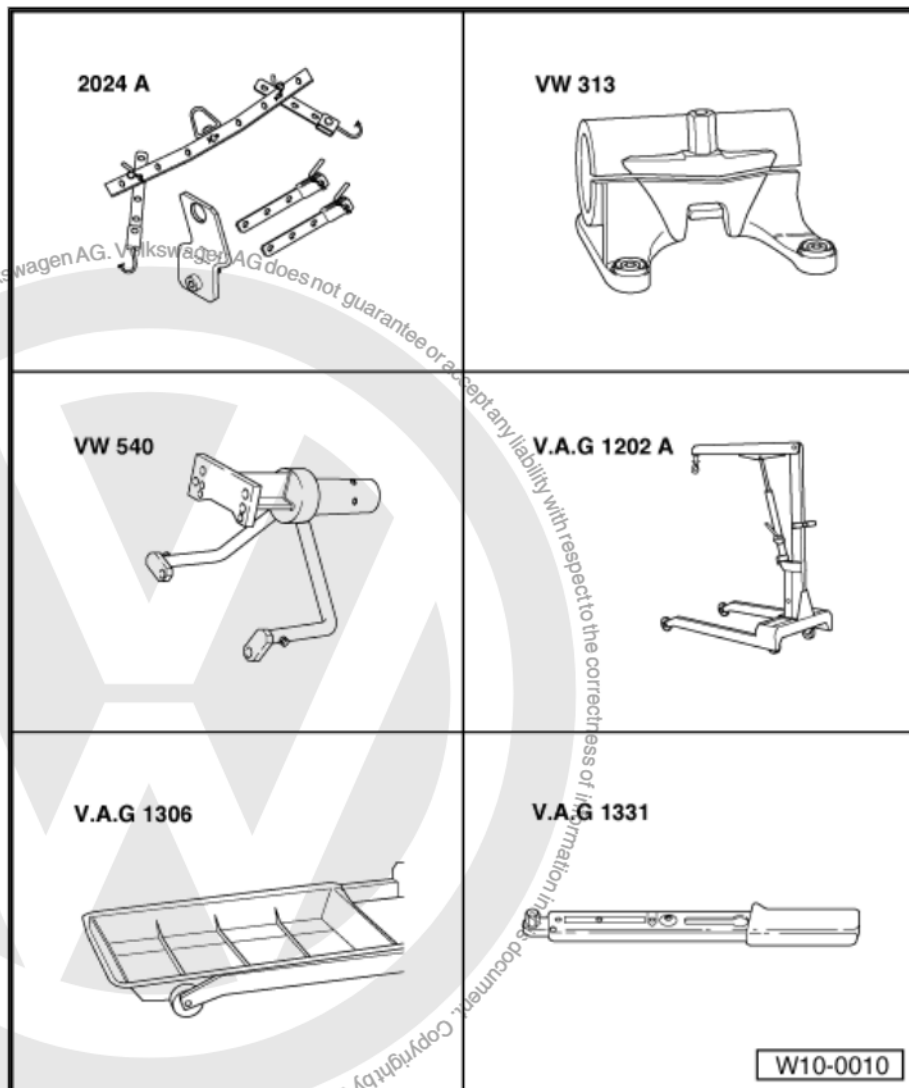


## 10 – Removing and installing engine

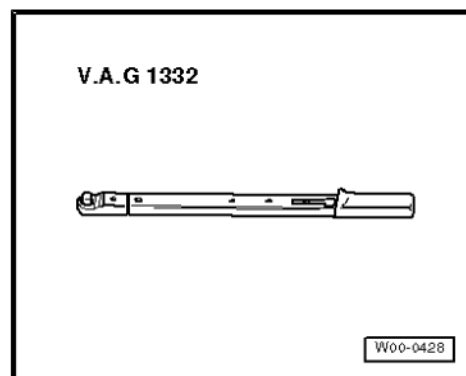
### 1 Removing and installing engine

Special tools and workshop equipment required

- ◆ Coupling equipment -2024A-
- ◆ Tension stand -VW 313-
- ◆ Engine and transmission bracket -VW 540-
- ◆ Hydraulic winch - V.A.G 1202A-
- ◆ Oil collector -V.A.G 1306-
- ◆ Torque wrench (5...50Nm) - V.A.G 1331-

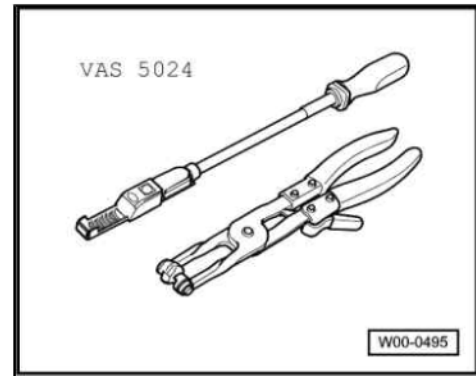


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- ◆ Suspension holes part number of replacement part -SJ 403 0103 390 F- (belt pulley side), -SJ 403 0103 390 G- (inertial flywheel side).
- ◆ Torque wrench (40...200Nm) -V.A.G 1332-
- ◆ Assembly tool for springtype clips -VAS 5024-
- ◆ Lubricating grease "G 000 100" (vehicles with mechanical transmission).
- ◆ Braces for cables.



## 1.1 Removal - indications



### Note

*Check whether vehicle has code radio, if so consult anti-theft code before disconnecting battery earth strap.*

- Engine is removed from the front, along with transmission.
- With ignition switched off disconnect battery earth strap.
- All cable fasteners that open or break during engine removal must be replaced and installed on the same locations when engine is installed.
- Remove air cleaner body ⇒ [page 115](#).
- Remove battery and battery retainer.
- Open and close cooling fluid container lid to release cooling system pressure.

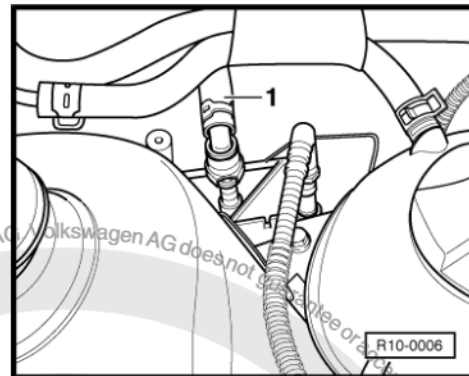


### WARNING

*Fuel supply hose is under pressure! Before loosening hose junctions, place a cloth around them. Next, eliminate pressure removing hose carefully.*



- Loosen fuel intake pipe 1 (press unlocking key).
- Loosen hose from electro-magnetic valve 1 -N80- on intake collector.
- Close tubes so that no dirt enters the fuel supply system.
- Respect cleaning rules ⇒ [page 87](#) .
- Disconnect or loosen the following components:
  - ◆ Vacuum hose of servo-brake intake collector
  - ◆ Cold start system electromagnetic valve hose
  - ◆ Engine rotation sensor connector sensor and intake collector pressure and intake air temperature sensor
  - ◆ Ignition transformer connector, Hall sender and butterfly control unit
  - ◆ Connector of coolant temperature sensor and oil pressure switch
  - ◆ Injection valve connectors
  - ◆ Lambda probe connector
  - ◆ Double connector of knock sensor (behind engine block)
- Remove/disconnect and loosen all transmission electrical cables, alternator and start engine.
- Remove/disconnect and loosen all other engine necessary electric cables.
- Remove engine vacuum and ventilation hoses.
- Remove lower engine compartment anti-noise. ⇒ Rep. Gr. 50 ; Front part; Removing and installing engine lower anti-noise
- Disconnect exhaust pipe from exhaust collector ⇒ [page 130](#) , exhaust collector, front exhaust pipe and assembly parts.





- Loosen hanging bracket -arrows-.
- Loosen gearbox mechanism: ⇒ Rep. Gr. 34 ; Repair gearbox mechanism
- Loosen starting cylinder of hydraulic clutch: ⇒ Rep. Gr. 30 ; Repair clutch starting

**Note**

*Clutch pedal must not be started.*

- Drain coolant ⇒ [page 77](#) .
- Remove engine coolant hoses using assembly tool for spring braces -VAS 5024- .

**Vehicles with air conditioning**

- Remove Poly-V belt ⇒ [page 16](#) .
- Loosen air conditioning compressor: ⇒ Rep. Gr. 87
- See notes and installation jobs ⇒ [page 10](#) .

**Continuation for all vehicles**

- Remove power steering oil pump and push-it away along with hoses ⇒ Rep. Gr. 48 ; Steering; Hydraulic pump, compensation reservoir, hydraulic pipes; Hydraulic pump installed on upper part - removing and installing
- Loosen right and left articulated shafts and fasten them on top ⇒ Rep. Gr. 40 ; Repairing articulated shafts; Removing and installing articulated shafts.
- Remove front panel and its components ⇒ Rep. Gr. 50 ; Body, front part; Removing and installing front panel
- Loosen coolant tubes from engine head.
- Install suspension holes on coolant pipes location on the head. Tightening torque: 25Nm.
- Fasten with coupling equipment -2024A- as described below and lift a little with winch.

Belt pulley side: 3 Hole of drilled edge in position 1.

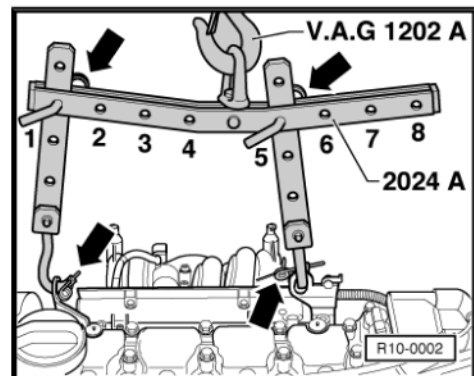
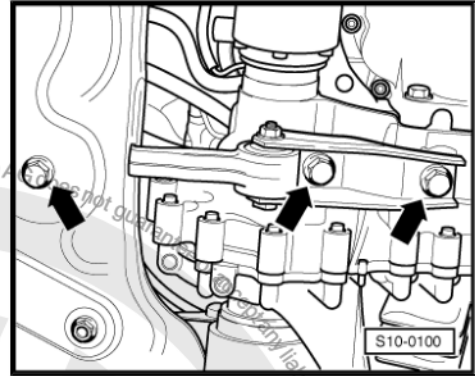
Inertial steering side: 3 Hole of drilled edge in position 5.

**WARNING**

*On hooks and pins, use safety locks -arrows-.*

**Note**

- ◆ *Positions numbered 1...4 on suspension bar face toward the pulley.*
- ◆ *Drilled holes on support are counted from the hook.*





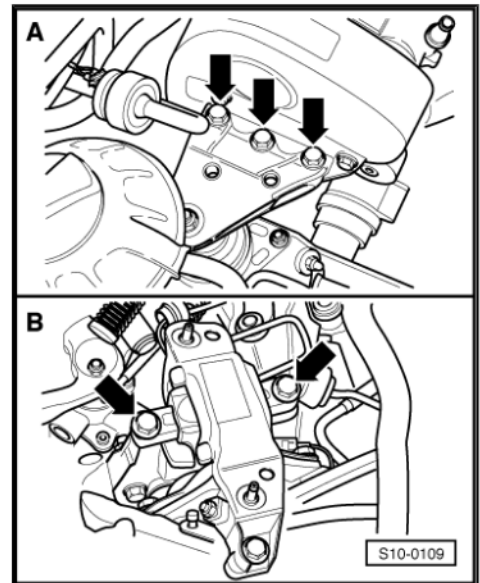


- Loosen frame on the transmission -B- and engine bracket -A- -arrows-.
- Lower frame until it is out of transmission case.
- Remove frame forward. In this case frame must be turned and slightly lowered, if necessary.



Note

*Frame must be carefully handled when removed, to prevent damages to the body.*

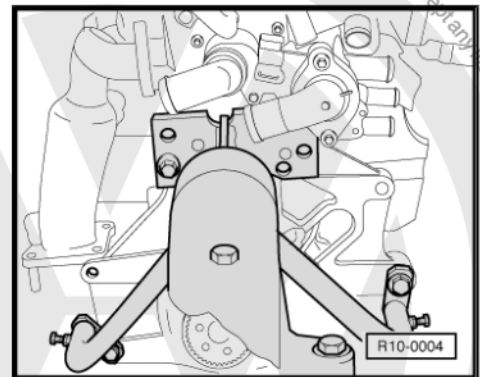


## 1.2 Fastening the engine to the assembly stand

To perform installation jobs, engine and transmission bracket -VW 540- must be fastened to tension stand -VW 313- of installation stand.

### Work sequence

- Remove transmission flange.
- Remove thrust plate.
- Remove inertial steering.
- Remove intermediate plate.
- Fasten engine with engine and transmission support -VW 540- to tension stand -VW 313- .



## 1.3 Notes on installation

Installation happens in removal reversed order, observing the following:



**WARNING**

*For removal jobs, especially in the engine compartment, due to reduced existing space, consider the following:*

- ◆ *All hoses (fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid vacuum) and electric cables must be restored to original positions.*
- ◆ *Ensure easy access to mobile parts that may be hot.*

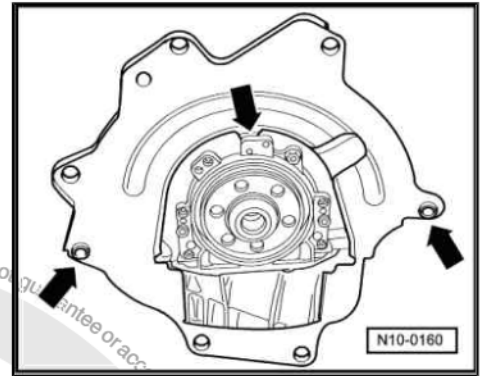
- Check clutch bearing for wear, replace if necessary.
- Slightly lubricate clutch bearing, guide sleeve for bearing of control axis with "G 000 100".
- If necessary, check centring of clutch disc.
- Check if transmission coupling guides for centring engine/transmission are placed on engine block and, if necessary, install them.



- Couple intermediate plate to sealing flange and move in sleeve direction -arrows-.
- When accessory is installed, pay attention to free passing of articulated shafts.
- Align engine, moving it-slightly so that brackets seat without tension.



Note

Tightening torque ⇒ [page 10](#)

- Install articulated shaft ⇒ Rep. Gr. 40 ; Repairing articulated shafts; Removing and installing articulated shafts

Vehicles with air conditioning

- Install air conditioning compressor.
- Install Poly-V belt ⇒ [page 16](#) .

Continuation for all vehicles

- Electric connections and their location ⇒ Rep. Gr. 97
- Loosen control cylinder of hydraulic clutch ⇒ Rep. Gr. 30 ; Servicing clutch control
- Install shift command ⇒ Rep. Gr. 34 ; Repair gearbox mechanism
- Install front exhaust pipe on exhaust collector ⇒ [page 130](#) , exhaust collector, front exhaust pipe with catalyst and assembly parts.
- Install lower engine compartment anti-noise.
- Fill coolant ⇒ [page 77](#)
- Loosen suspension holes of engine head.
- Install coolant pipes on engine head. Tightening torque: 25Nm.
- Install air cleaner body ⇒ [page 115](#) .
- Adjust engine control unit to butterfly control unit ⇒ [page 128](#) Adjust components.
- Run test drive and interrogate fault memory ⇒ [page 128](#) .

## 1.4 Tightening torque

Location		Tightening torque
Bolts, nuts	M6	10Nm
	M8	20Nm
	M10	45Nm
	M12	60Nm
Different tightening torques		
Exhaust pipe on exhaust collector		40Nm



Note

Agregado housing tightening torque ⇒ [page 10](#) .



## 1.5 Engine group mounting

### 1.5.1 Tightening torque



Note

*Securing bolts of frame housing are expanding bolts and must be replaced.*

Engine frame housing.

A<sup>1)</sup> = 20Nm + 90°

B<sup>1)</sup> = 30Nm + 90°

1) Renew.

Transmission frame housing.

A<sup>2)</sup> = 50Nm + 90°

B<sup>2)</sup> = 40Nm + 90°

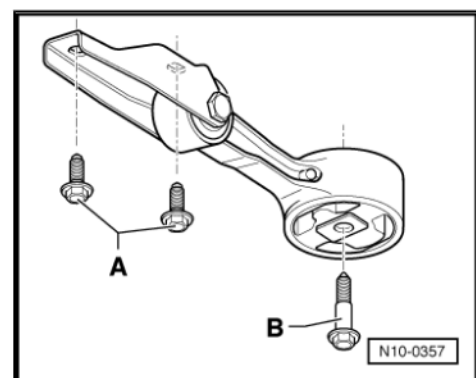
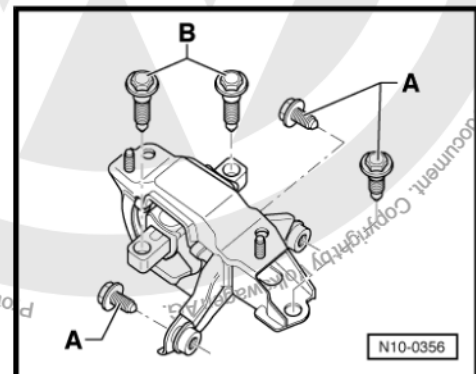
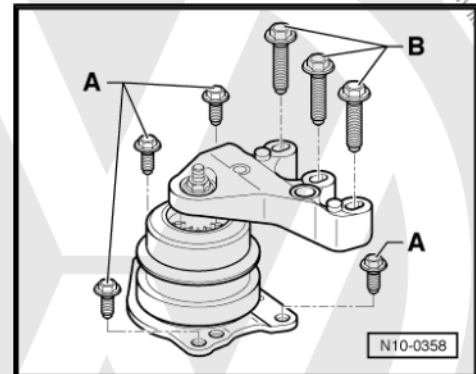
2) Renew.

Hanging bracket.

A<sup>3)</sup> = 30Nm + 90°

B<sup>3)</sup> = 40Nm + 90°

3) Renew.



## 1.6 Additional indications and installation jobs in vehicles with air conditioning



WARNING

*Air conditioning cooling gas circuit must not be opened.*

**Note**

*To prevent damages to condenser and refrigerant hoses, do not kink, twist or over stretch tubes/hoses.*

To facilitate removal and installation of the engine without having to open the refrigerant circuit:

- Loosen brace(s) of refrigerant hoses.
- Remove Poly-V belt ⇒ [page 16](#) .
- Remove front panel and its components ⇒ Rep. Gr. 50 ; Body, front part; Removing and installing front panel
- Remove panel with radiator and condenser to the side so that refrigerant hoses are not stretched.
- Remove air conditioning compressor ⇒ Rep. Gr. 87





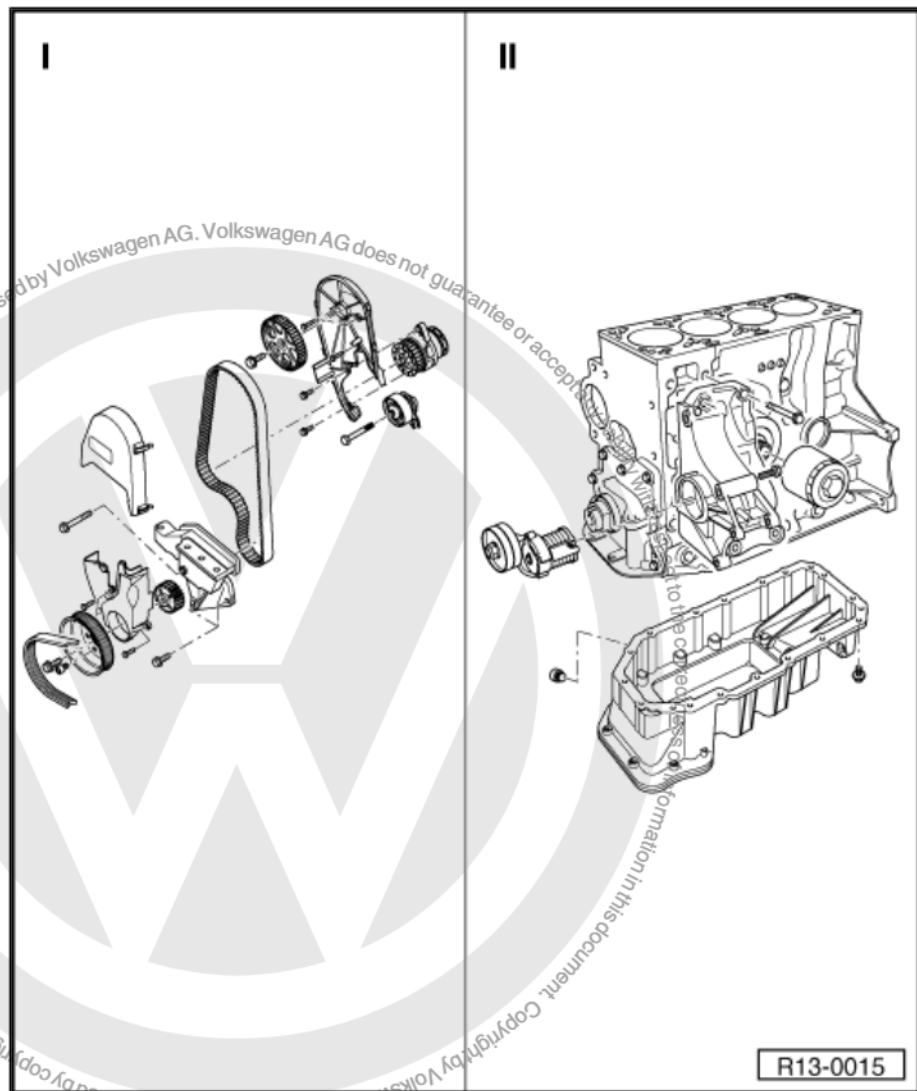
## 13 – Crankshaft group

### 1 Dismantling and assembling - engine



#### Note

*To carry out disassembly operations, engine must be fixed with engine and gearbox bracket -VW 540- on the installation stand.*



#### Note

- ♦ *If significant quantities of metallic chips, resulting from friction on the crankshaft bearings and rods, are noticed in the engine oil during engine repairs it is necessary to replace oil filter and carefully clean oil ducts.*
- ♦ *All housing and bearing surfaces must be lubricated with oil before assembly operations.*

I ➤ [page 13](#)II ➤ [page 14](#)

## Part I

1 - Manual gearbox upper guard cover

2 - Toothed belt

- ☐ Mark rotation direction before removal.
- ☐ Check wear.
- ☐ Do not kink.
- ☒ Remove and install, adjust ➤ [page 40](#).

3 - Tighten with 20Nm + 90°

- ☐ Renew.
- ☐ To loosen and tighten, hold camshaft sprocket with special-wrench -3036-.

4 - Camshaft sprocket

- ☐ Ensure proper fastening when installing.
- ☐ Observe installation position when installing toothed belt ➤ [page 40](#).

5 - 10Nm

- ☐ Apply with D/00600/A2/.

6 - Rear manual gearbox guard

7 - Water pump

- ☐ With integral sealing gasket.
- ☐ Water pump integrated gasket must not be separated from pump.
- ☐ In case of faults and leakage, renew complete pump and seal.
- ☐ Ensure it turns smoothly.
- ☐ Removing and installing ➤ [page 82](#).

8 - Toothed belt tension pulley

- ☐ Check ➤ [page 38](#).
- ☐ Toothed belt: remove and install, adjust ➤ [page 40](#).

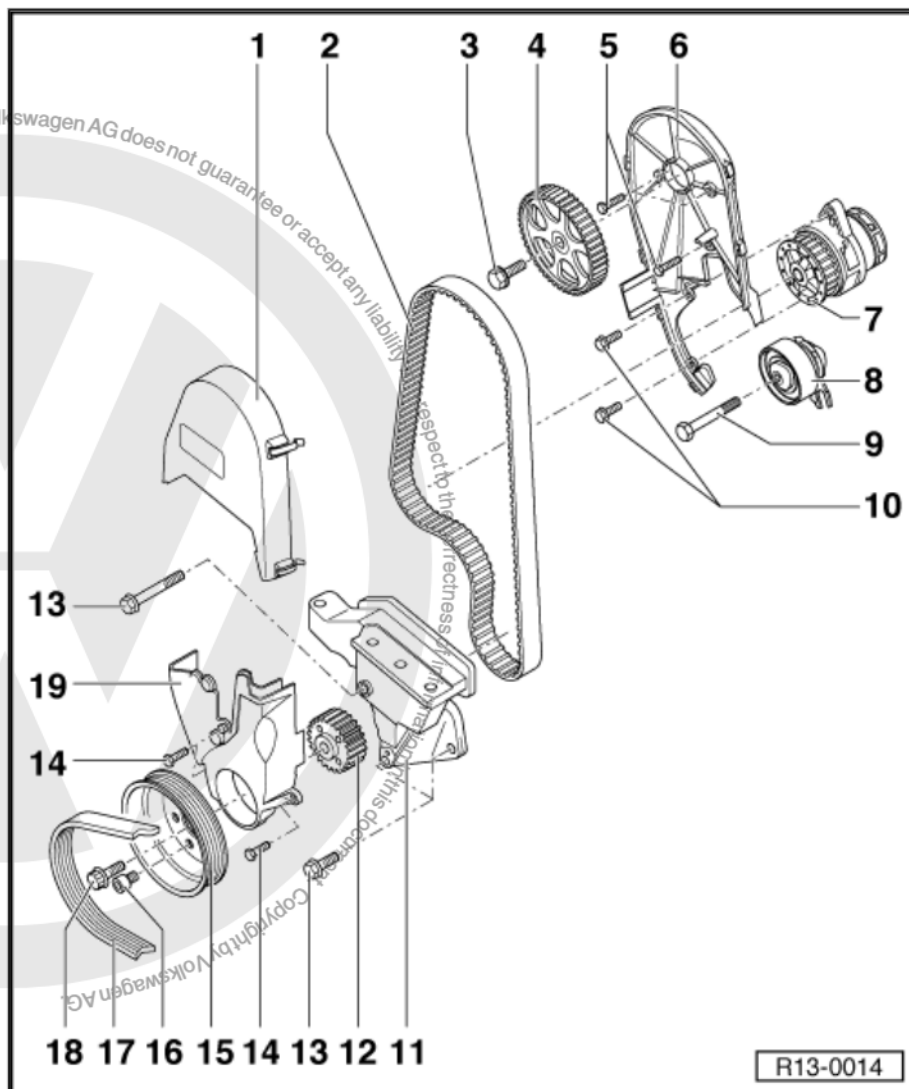
9 - 20Nm

10 - 20Nm

11 - Engine bracket

12 - Crankshaft sprocket

- ☐ Observe installation position when installing toothed belt ➤ [page 40](#).





13 - 50Nm

14 - 10Nm

15 - Belt pulley

- ☐ Ensure proper fastening when installing.
- ☐ Removal and installation ⇒ [page 40](#) , Removing, installing and adjusting toothed belt.
- ☐ Remove and install Poly-V belt ⇒ [page 16](#) .

16 - 20Nm

17 - Poly-V belt

- ☐ Mark rotation direction before removal.
- ☐ Remove and install Poly-V belt ⇒ [page 16](#) .
- ☐ Poly-V belt course ⇒ [page 16](#) .

18 - Tighten with 90Nm + 90°

- ☐ Renew.
- ☐ To loosen and tighten, use wrench -3415- .
- ☐ Tightening continuation may be done in many phases.
- ☐ Tightening continuation angle may be measured with a regular angle measuring disc, like a Hazet 6690.

19 - Mechanical distribution lower guard

## Part II



### Note

*Clutch repairs: ⇒ Rep. Gr. 30 ; Clutch repairs; remove/install clutch*







## 1 - Engine block

- ☐ Removing and installing crankshaft  
⇒ [page 31](#).
- ☐ Removing and installing pistons and conrods  
⇒ [page 33](#).

## 2 - 50Nm

- ☐ Tightening sequence: first tighten upper right bolt, then lower right bolt, and last, the left bolt (seen from the front, in vehicle movement direction).

## 3 - Oil filter

- ☐ Loosen through six-sided.
- ☐ Tighten manually.
- ☐ Follow oil filter installation instructions.

## 4 - M8: Tighten with 20Nm + 90° M10: 45Nm

## 5 - Tighten with 10Nm + 90°

- ☐ Renew.
- ☐ Loosen oil sump fastening bolts from engine block on pulley side (4 units) inside oil sump.

## 6 - Oil sump

- ☐ Two pieces.
- ☐ Clean sealing surface before installation.
- ☐ Insert with silicone sealant "D 176 404 A2".
- ☐ To remove and install, remove oil sump cover.
- ☐ Removing and installing ⇒ [page 65](#).

## 7 - Oil draining plug, 30Nm

- ☐ With integrated sealing ring.
- ☐ Renew.

## 8 - Compact bracket

- ☐ For alternator, air conditioning compressor, power steering oil pump and Poly-V belt securing element.
- ☐ Remove and install compact bracket in vehicles with air conditioning: ⇒ Rep. Gr. 87.

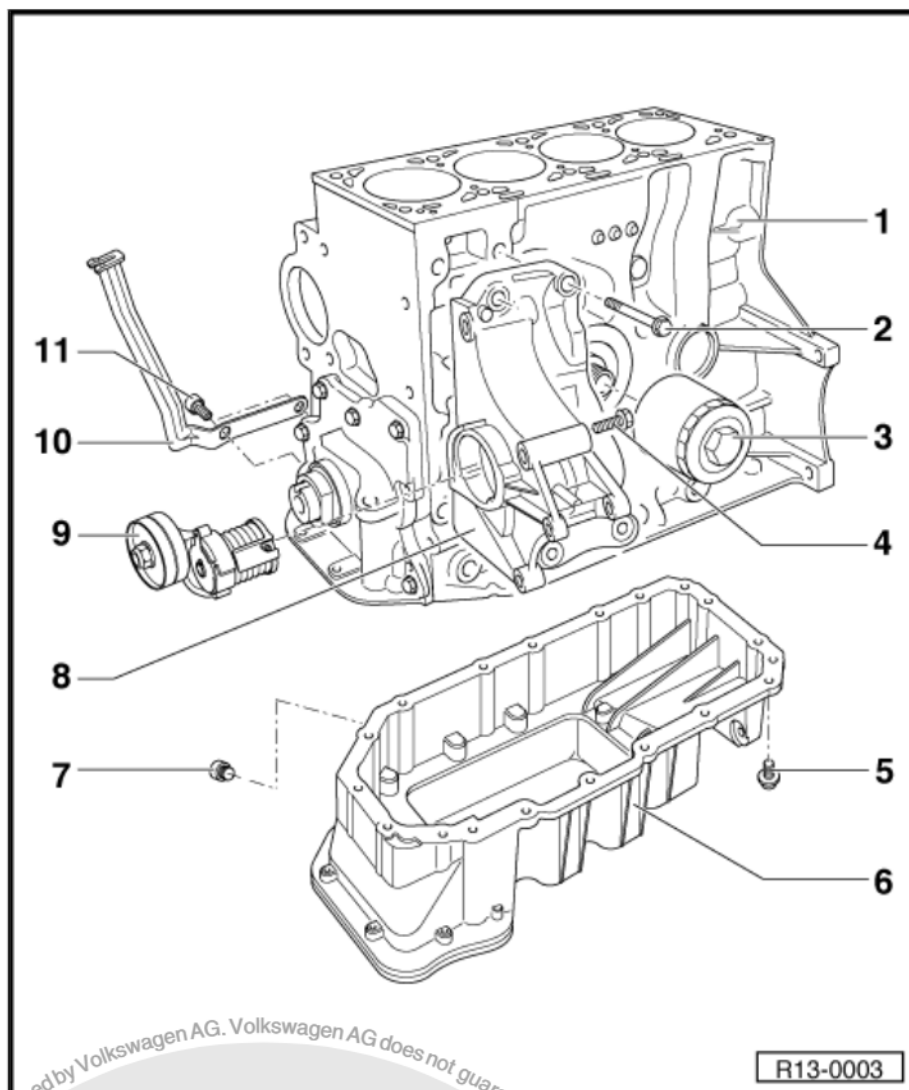
## 9 - Tensioner

- ☐ For Poly-V belts.
- ☐ Only vehicles with air conditioning.
- ☐ Turn with 16mm screwdriver to loosen Poly-V belt.
- ☐ Remove and install Poly-V belt ⇒ [page 16](#).

## 10 - Bracket

- ☐ For connectors.

## 11 - 40Nm





## 1.1 Removing and installing Poly-V belt

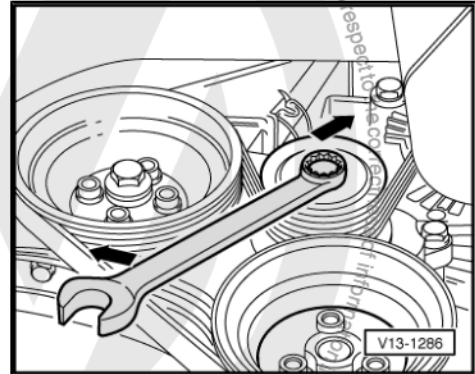
Only for vehicles with air conditioning compressor

Special tools and workshop equipment required

- ◆ 16mm screwdriver

### 1.1.1 Removing

- Remove lower engine compartment anti-noise.
- Mark Poly-V belt operation direction.
- To loosen Poly-V belt, turn-belt tensor in arrow direction with 16mm screwdriver.
- Remove Poly-V belt.



### 1.1.2 Installing

- First, place Poly-V belt on crankshaft pulley. Next, place pulley on the tensor.

Install in reverse order.



Note

- ◆ Before installing Poly-V belt-ensure all frames (alternator, air conditioning compressor) are properly installed.
- ◆ During Poly-V belt installation-ensure correct movement direction and proper seating of belt on the pulley.

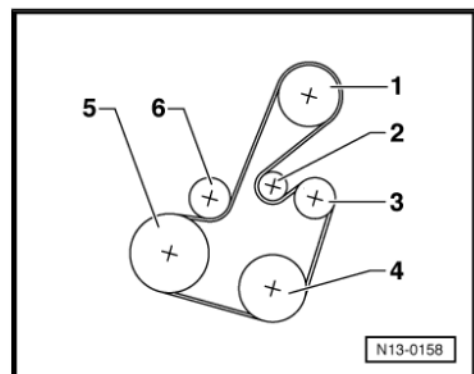
After job conclusion, always:

- Start engine and check turn (movement) of belt.

### 1.1.3 Poly-V belt course

Belt course with power steering pump and air conditioning compressor

- 1 - Power steering pump pulley
- 2 - Resending pulley
- 3 - Alternator pulley
- 4 - Air conditioner compressor
- 5 - Crankshaft pulley
- 6 - Tensioning roller

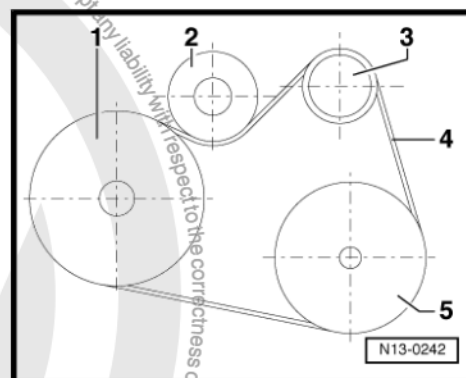




Belt course with power steering pump and without air conditioning compressor

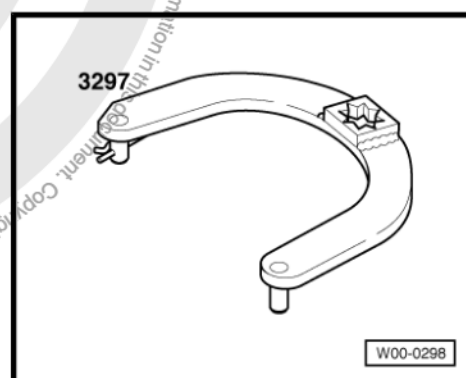
- 1 - Crankshaft pulley
- 2 - Tension pulley
- 3 - Alternator pulley
- 4 - Poly-V belt
- 5 - Power steering pump pulley

Vehicles without air conditioning compressor and power steering

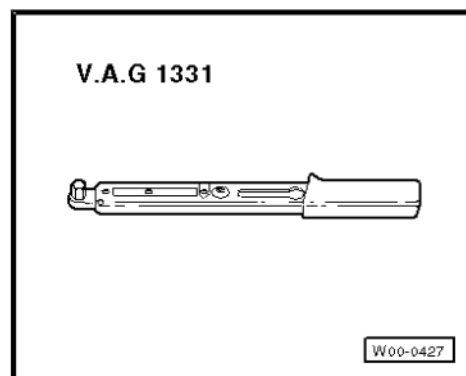


Special tools and workshop equipment required

- ◆ Tension lever -3297- or -VW 5329/7-

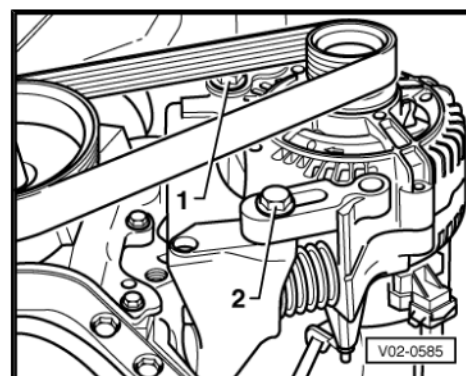


- ◆ Torque wrench (5...50Nm) -V.A.G 1331-



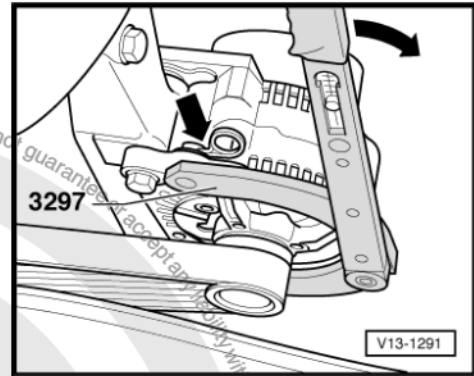
### 1.1.4 Removing

- Mark Poly-V belt operation direction.
- Loosen securing bolts -1- and -2- of alternator, in at least one turn.





- Position tension lever -3297- , lock with fitting pin and turn alternator downwards (with -3297- starting, use torque wrench, for example).
- Remove Poly-V belt.



### 1.1.5 Install Poly-V belt.



#### Note

*During Poly-V belt installation-ensure correct movement direction and proper seating of belt on the pulley.*

- Press alternator until frame of tension spring with tension pulley -3297- at least three times, to ensure optimal rotation.
- Next, press alternator with tension pulley -3297- against belt tensor until Poly-V belt may be installed on the pulley.
- After Poly-V belt installation, let engine run several times with alternator loose (approx. 11 engine turns). For that, briefly activate start engine.



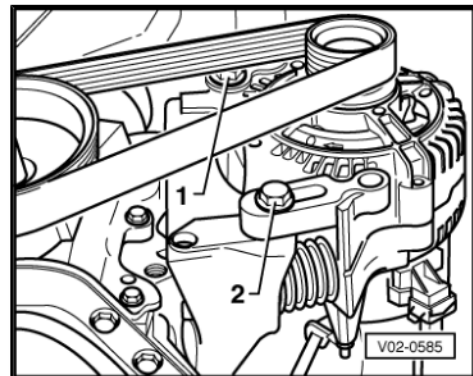
#### Note

*In the subsequent tightening of alternator bolts, respect tightening sequence and do not touch Poly-V belt.*

- First tighten securing bolt -2- at 25Nm and, next, the securing bolt -1- at 25Nm.

After job conclusion, it-is necessary:

- Start engine and check belt turn.

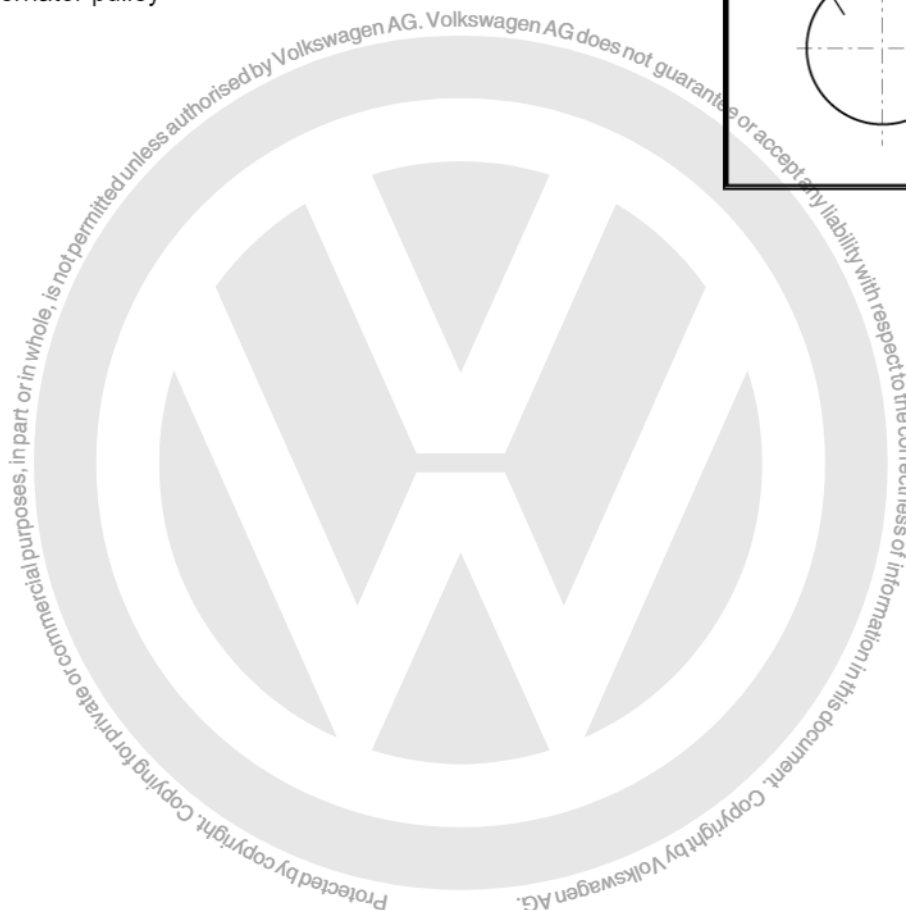
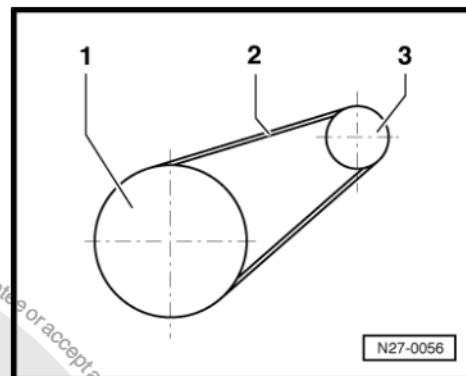




### 1.1.6 Poly-V belt route

Belt route without power steering pump and air conditioning compressor.

- 1 - Crankshaft pulley
- 2 - Poly-V belt
- 3 - Alternator pulley





## 2 Removing and installing crankshaft flanges (flywheel side)



### Note

Clutch repairs: ⇒ Rep. Gr. 30 ; Clutch repairs; remove/install clutch

1 - 10Nm

2 - Suction line

3 - Engine block

- ☐ Dismantling and assembling crankshaft ⇒ [page 31](#) .

- ☐ Dismantling and assembling pistons and con-rods ⇒ [page 33](#) .

4 - Knock sensor

5 - 20Nm

- ☐ Tightening torque influences the function of the knock sensor.

6 - Tighten with 60Nm + 90°

- ☐ Renew.

7 - Flywheel

- ☐ To remove and install flywheel immobilise with lock -3067- .

8 - Intermediate plate

- ☐ Must seat on coupling guides.
- ☐ Do not damage/warp when assembling.

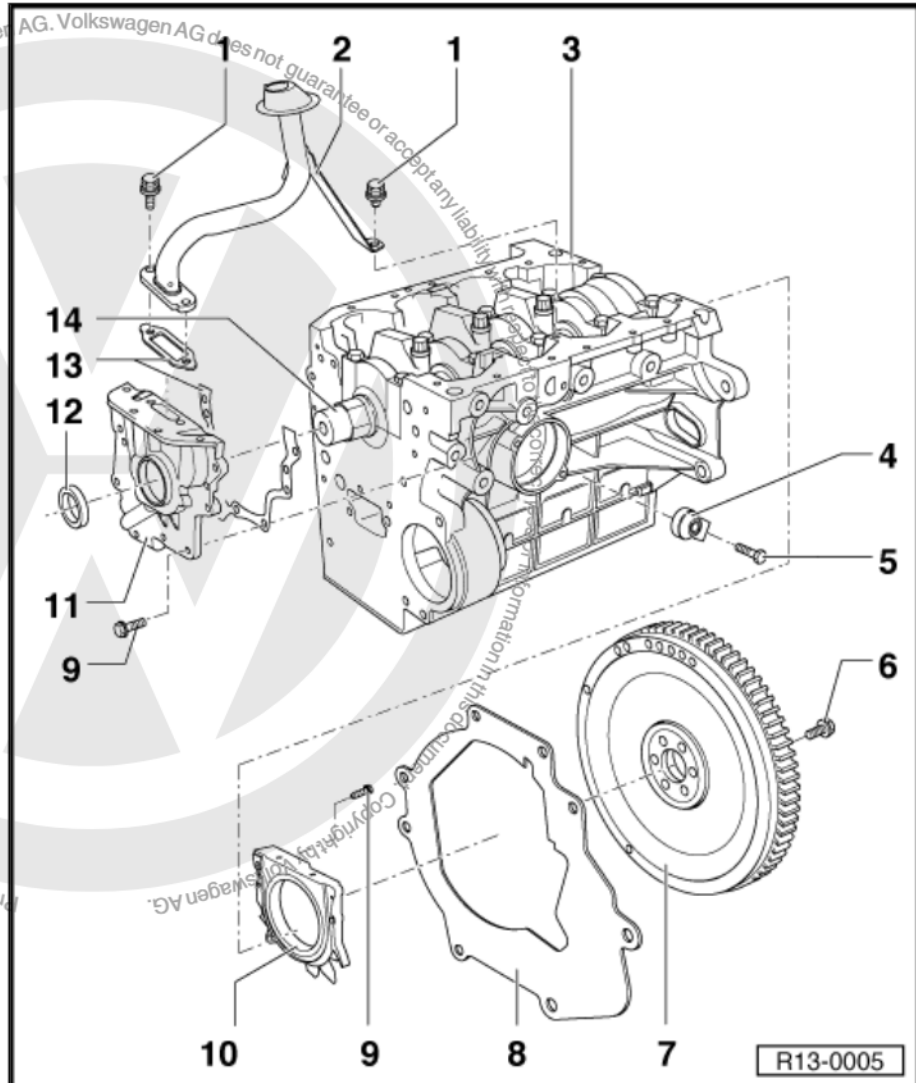
9 - 10Nm

10 - Removing and installing crankshaft flanges (flywheel side) with sensor rotor and sealing ring

- ☐ Only renew complete with sealing ring and sensor rotor.
- ☐ Use the supplied sleeve for installation.
- ☐ To remove and install, remove oil sump.
- ☐ Do not lubricate or apply oil to sealing ring lip.
- ☐ Before installing, remove oil remains from crankshaft journal with a clean cloth.
- ☐ Sleeve may be removed after flange installation on the crankshaft journal.
- ☐ Removing and installing flange ⇒ [page 23](#) .

11 - Crankshaft/oil pump flange

- ☐ Replace only complete set.
- ☐ Must be seated on the guide pins.
- ☐ To remove and install, remove oil sump.





- ☐ Observe crankshaft journal position during installation ⇒ [Item 14 \(page 21\)](#) .
- ☐ Removing and installing oil pump ⇒ [page 68](#) .

## 12 - Renewing crankshaft seal

- ☐ Renew ⇒ [page 21](#) .

## 13 - Sealing gasket

- ☐ Renew.

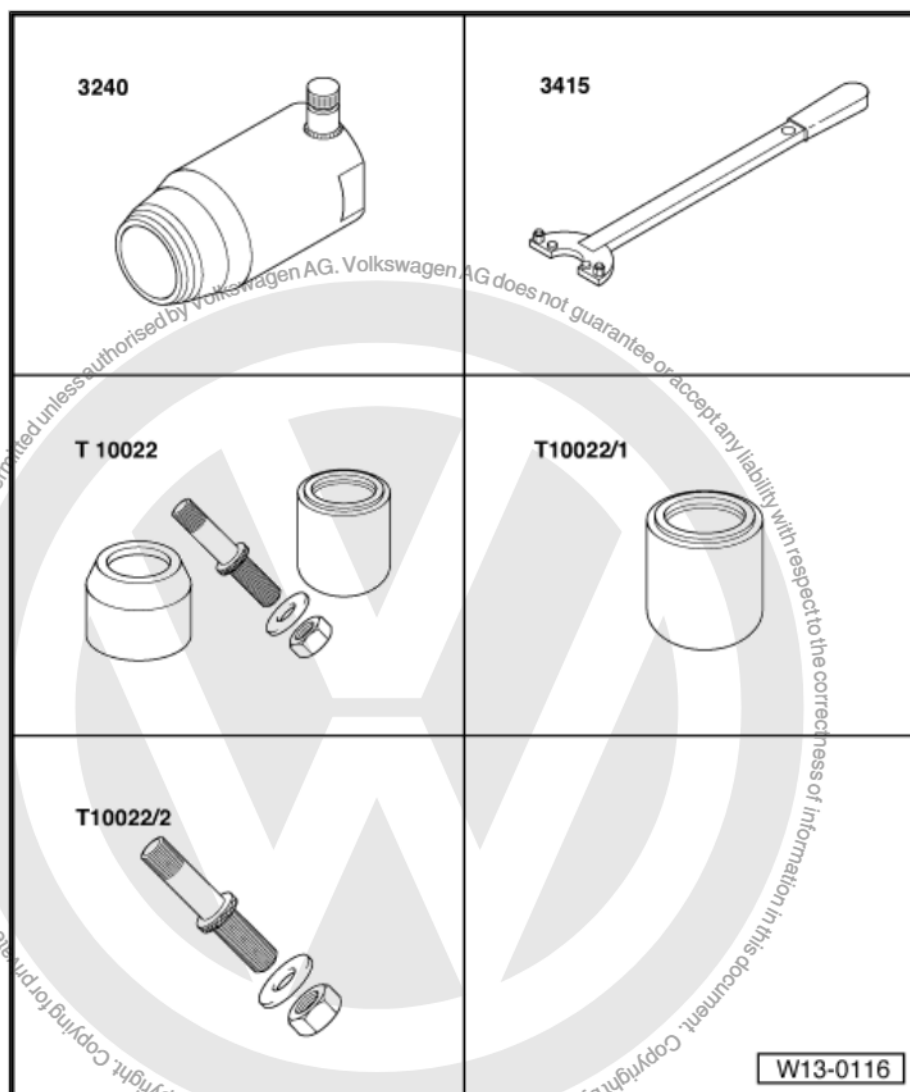
## 14 - Crankshaft journal

- ☐ Lubricate with oil before installing oil pump.

## 2.1 Renewing crankshaft seal (pulley side)

Special tools and workshop equipment required

- ◆ Puller -3240-
- ◆ Key -3415-
- ◆ Sleeve -T10022-
- ◆ Press piece -T10022/1-
- ◆ Threaded piece -T10022/2-

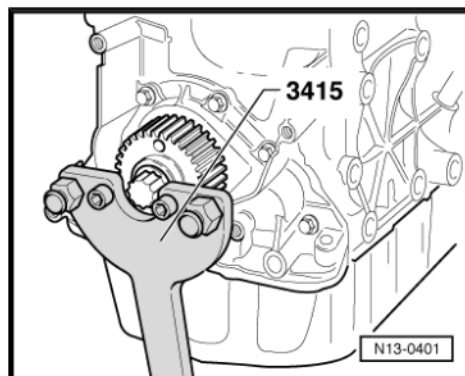


### 2.1.1 Removing

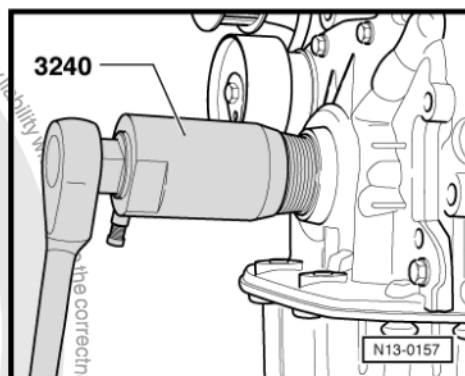
- First remove toothed belt ⇒ [page 40](#) .



- Remove crankshaft sprocket. To do so, lock gear with counter support -3415- .
- To guide seal puller, screw centre bolt into crankshaft onto limit stop.
- Turn internal part of seal -3240- puller twice (approx. 3mm) of the external part and lock with socket head bolt.

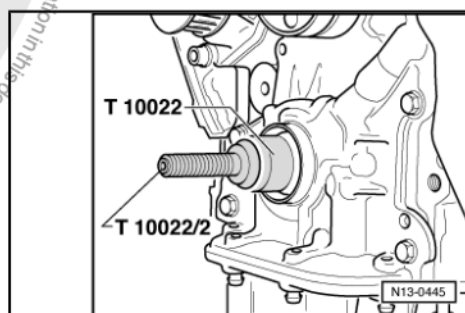


- Lubricate puller threaded head, seat it and tighten firmly onto the seal.
- Loosen socket head bolt and turn inner part against crankshaft until the oil seal is pulled out.

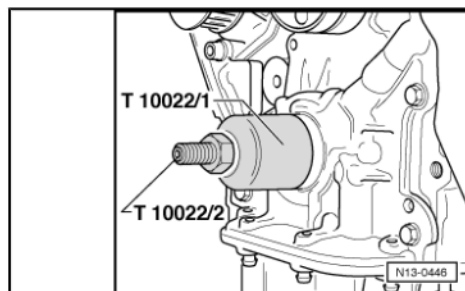


## 2.1.2 Installing

- Do not additionally oil or grease the seal sealing lip.
- Apply assembly sleeve -T10022- onto crankshaft journal and screw with threaded piece until stop.
- Move seal through guide sleeve.



- Press seal with pressure sleeve -T10022/1- until stop.

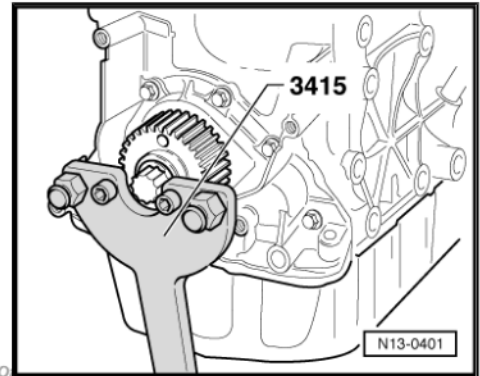




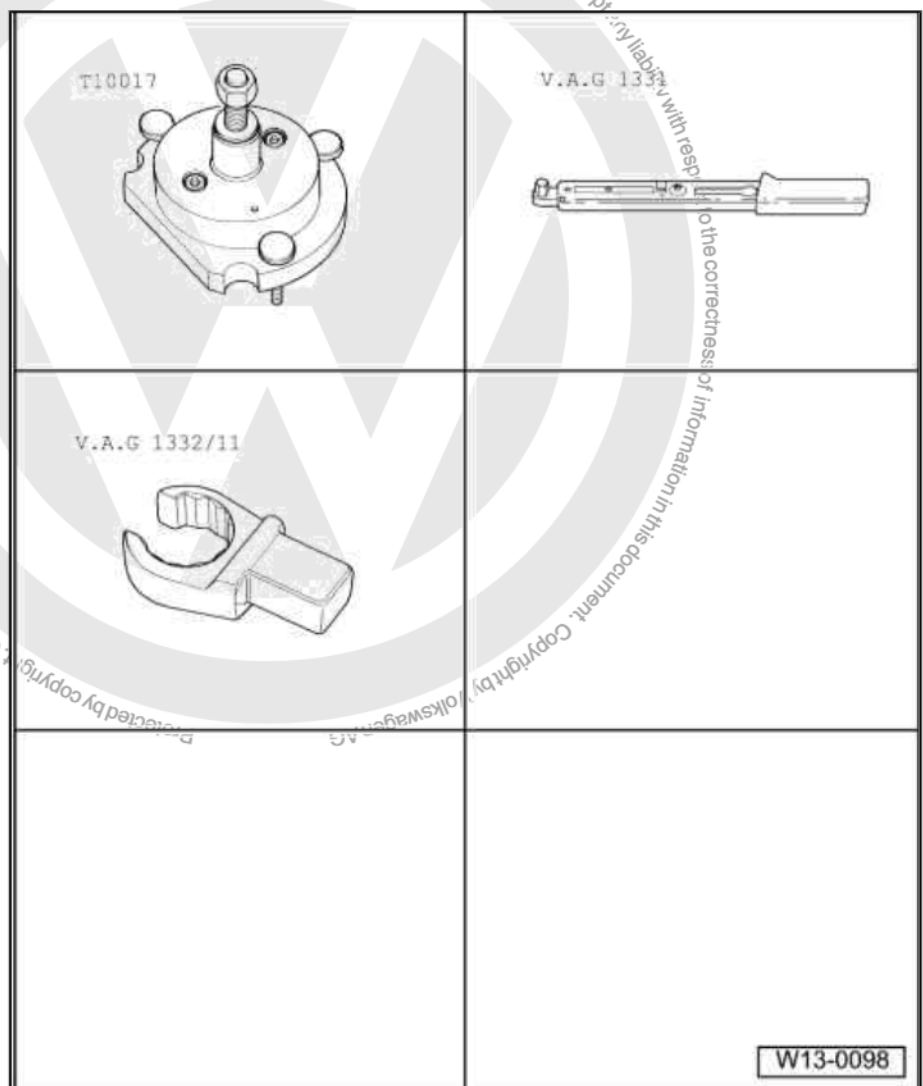


- Install crankshaft sprocket and lock with -3415- .
- Tighten new centre bolt with 90Nm and continue turning 90° (tightening continuation may be carried out in steps).

How to install toothed belt and adjust control times ➔ [page 40](#) .



## 2.2 Renewing crankshaft flange (flywheel side)



### 2.2.1 Special tools, workshop equipment, checking and measuring equipment, and necessary auxiliary devices

- ◆ Assembly tool -T10017- or Assembly tool -T10017K- or Assembly tool -T 10134-
- ◆ Torque wrench (5...50Nm) -V.A.G 1331-



- ◆ Open screwdriver -V.A.G 1332/11-
- ◆ Three six-sided head bolts M6×35mm
- ◆ Feeler gauge
- ◆ Measuring displacement



Note

*For flange SABÓ, use the Assembly tool -T10134- or Assembly tool -T10017K-, and for flange Freudenberg use the Assembly tool -T10017-. For both tools, the method is the same, and the reference for flange assembly with the rotation sensor with these tools is: SABÓ upper region and Freudenberg lower region.*

## 2.2.2 Removing and installing crankshaft flanges (flywheel side) with sensor rotor



Note

- ◆ *To better show operation sequence, it is carried out with engine removed.*
- ◆ *Operation sequences with engine removed and transmission removed are identical.*

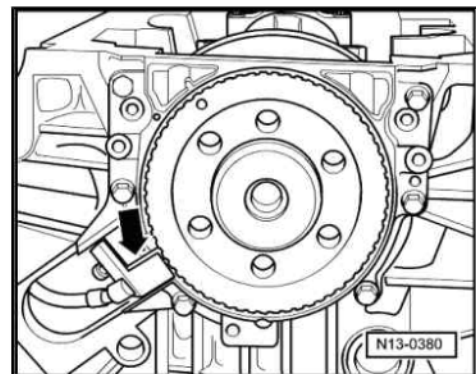
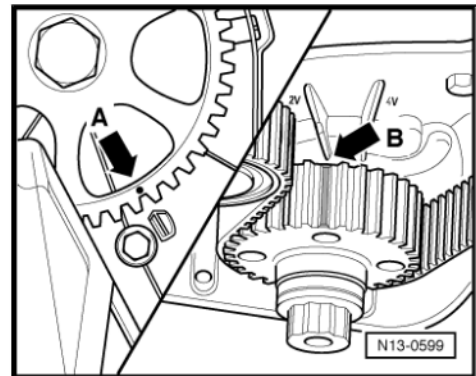
### Work sequence

- Remove flywheel.
- Remove intermediate plate.
- Place camshaft sprocket on the mark -arrow A-.
- Place crankshaft in cylinder upper neutral position of cylinder 1. Tooth marked on the crankshaft sprocket must meet the marking -2V- on the flange/oil pump -arrow B-.
- Remove oil sump ⇒ [page 65](#).
- Remove engine rotation sensor -arrow-.
- Loosen flange securing bolts.



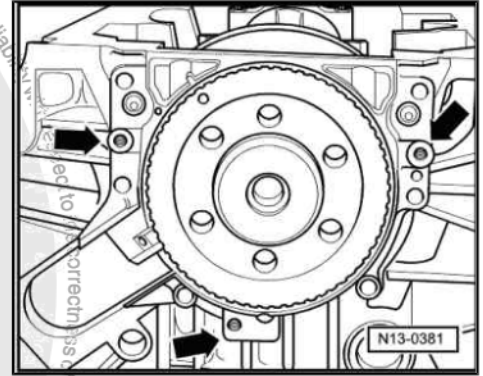
Note

*Flange and rotor are pulled together from crankshaft with three M6×35mm bolts.*





- Fasten three M6×35mm bolts to threaded ports of flange/oil pump -arrows-.
- Tighten bolts, alternating among them (max. one  $\frac{1}{2}$  turn (180°) per bolt), onto flange and separate them from crank shaft along with sensor rotor.

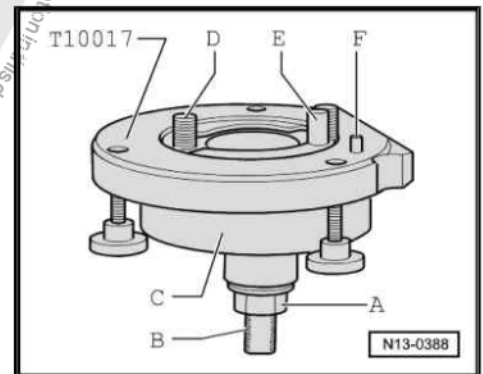


## 2.2.3 Install flange with sensor rotor



### Note

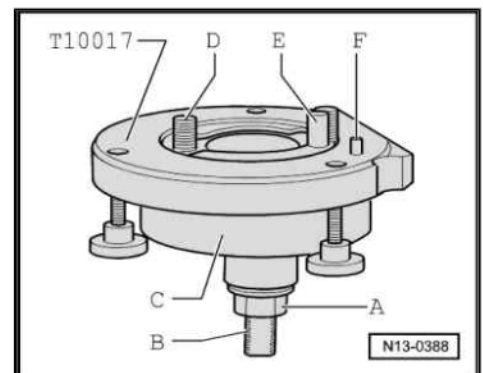
- ◆ Flange with seal PTFE is provided with a support ring for the sealing lip. The support ring acts as an assembly guide and cannot be removed before installation.
- ◆ Flange and sensor rotor cannot be separated or turned after they're removed from the spare parts package.
- ◆ Sensor rotor installation position is fitted to fitter securing pin.
- ◆ Sealing flange and sealing ring are a single unit and can only be renewed along with sensor rotor.
- ◆ Fitter installation position in relation to crankshaft is attained through a guide-pin, that is guided through a crankshaft threaded hole.



- A - Six-sided nut
- B - Threaded spindle
- C - Assembly body
- D - Allen screw
- E - Guide pin
- F - Securing clip

A-Install flange with rotor on fitter

- Tighten six-sided nut -A- until a little before the spindle threaded flat tightening surface -B-.



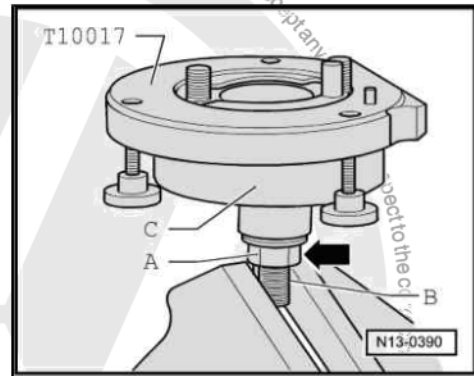


- Fasten fitter to tightening surface -B- of threaded piece to a vise.
- Press assembly body -C- downward, so that it leans on the six-sided nut -A- -arrow-.



Note

*Internal part of assembly device and assembly body must be on the same level.*

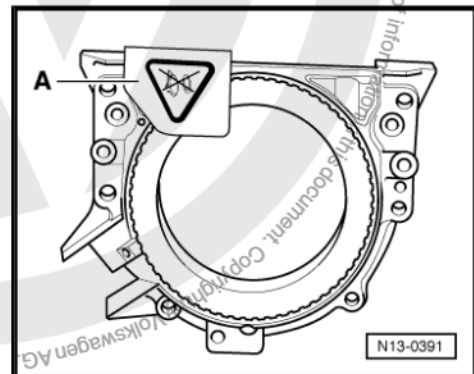


- Remove new flange securing clip -A-.

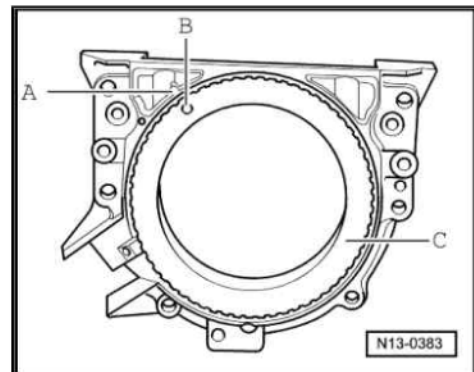


Note

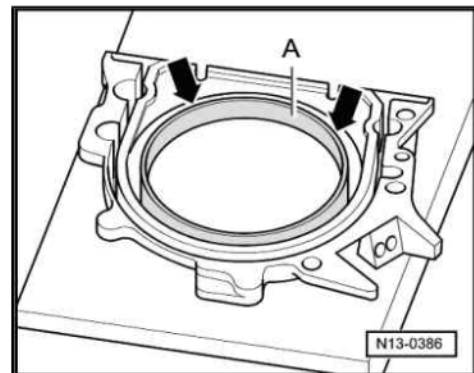
*Sensor rotor cannot be removed from flange or turned.*



The securing hole -B- on sensor sprocket -C- must be aligned with mark -A- on the flange.

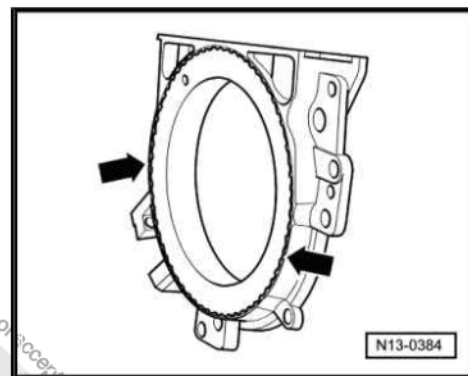


- Place flange with front part on a flat and clean surface.
- Press seal lip support ring -A- in downward arrow direction, until it seats onto the flat surface.





Upper rotor corner and front flange corner must be aligned -arrows-.

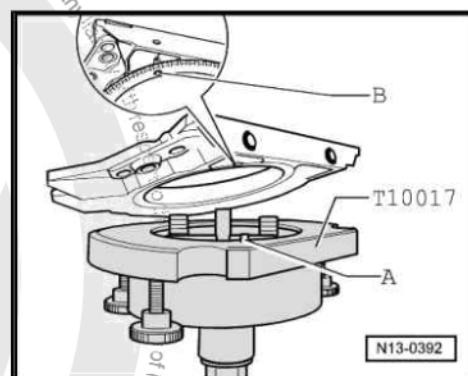


- Place flange with front side onto -T10017- so that the securing pin -A- is on the sensor rotor -B- hole.



Note

Ensure the flange is not inclined on the fitter.

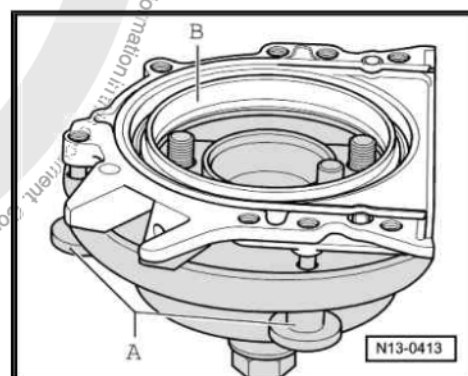


- Press sealing lip supporting ring -B- during the tightening of the three socket head bolts -A- against fitter surface, so that the securing pin cannot move out the sensor rotor hole.



Note

Ensure the sensor rotor remains fastened to fitter during flange installation.



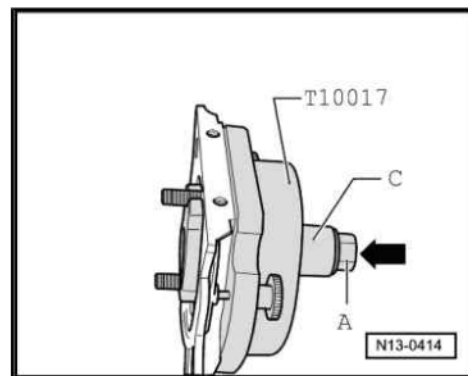
B-Install assembly device fitter with flange on the crankshaft

Prerequisites

- Crankshaft flange must be free from oil and lubricants.
- Engine is in upper neutral position of cylinder. 1.

Work sequence

- Tighten six-sided nut -A- until the end of threaded piece.
- Press fitter threaded piece in arrow direction until the six-sided nut -A- leans on the assembly body -C-.
- Align the assembly body flat side for sealing surface to the block oil sump side.





- Fasten fitter with Allen screws -A-, to crankshaft flange.

**Note**

*Insert Allen screws -A- in approx. 5 thread turns to crankshaft flange.*

- Tighten the two M6×35mm bolts -A- to guide flange on the engine block.

C-Tighten fitter on the crankshaft flange

- Manually slide assembly body -A- in arrow direction until seal lip support ring -B- seats on crankshaft flange -C-.

**Note**

*The fitter guide -D- pin is inserted in a threaded hole on the crankshaft during assembly. The sensor rotor will then be in definitive assembly position.*

- Keep assembly body in this position and manually tighten Allen screws of assembly device.
- Manually tighten six-sided nut -E- on the threaded piece until it seats on the assembly body -A-.

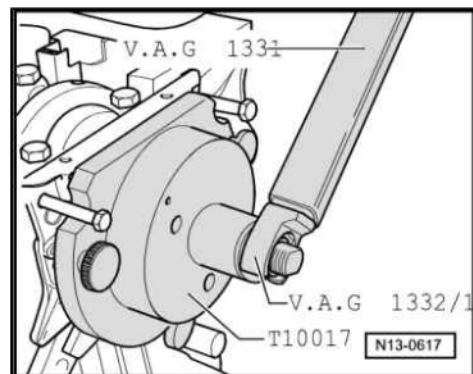
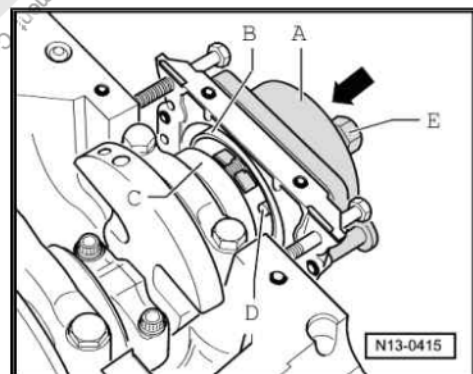
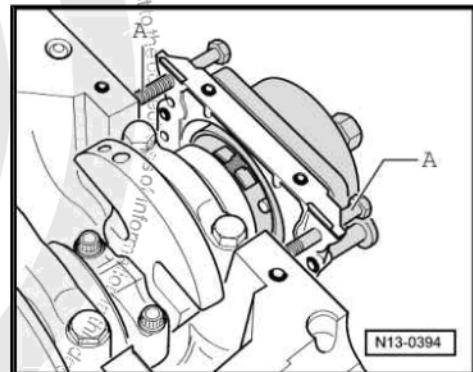
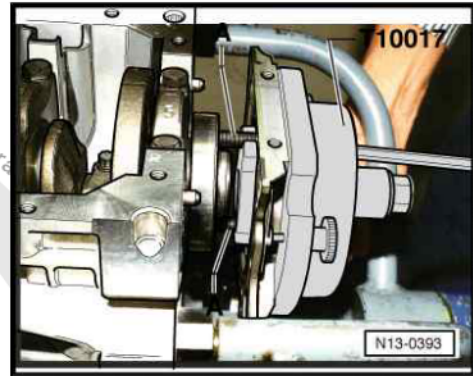
D-Install sensor rotor with fitter on the crankshaft flange

- Tighten fitter six-sided nut with torque wrench -V.A.G 1331- and key -V.A.G 1332/11-. Tightening torque: 35Nm.

**Note**

*After tightening the six-sided nut with 35Nm there must be a small gap between engine block and flange.*

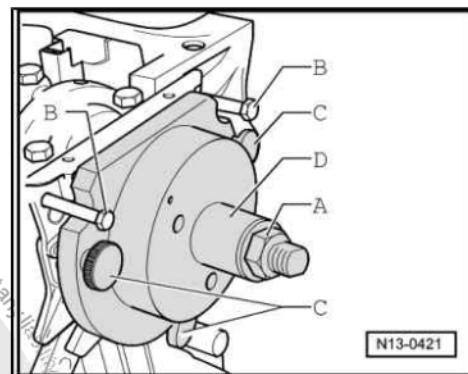
E-Check assembly position of crankshaft sensor rotor



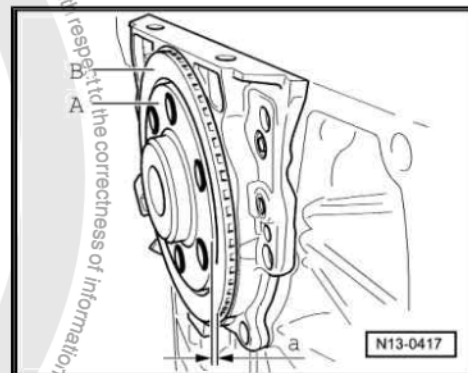




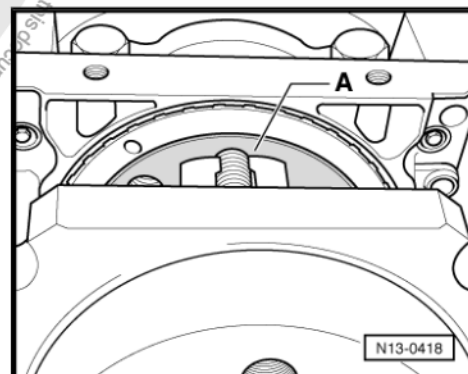
- Tighten six-sided nut -A- until the end of threaded piece.
- Fasten two M6×35mm bolts -B- onto engine block.
- Loosen the three flange socket head bolts -C-.
- Pull off fitter.
- Remove seal lip support ring.



Sensor rotor is in correct assembly position on the crankshaft when there is some distance between flange -A- and sensor rotor -B- -a- of 0.5mm



- Place gauge rod or steel ruler against crankshaft flange -A- (marked surface).



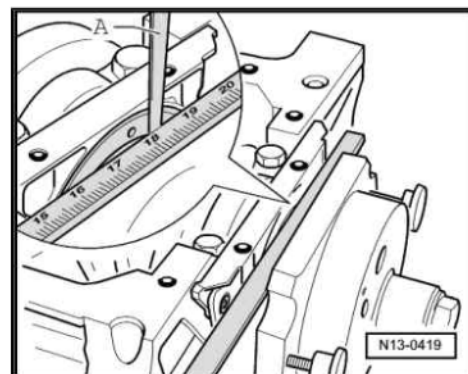
- Measure with feeler gauge -A- the distance -a- between gauge rod and rotor.

If distance -a- is too small:

- Compress sensor rotor a bit more ➔ [page 30](#)

If distance -a- is OK:

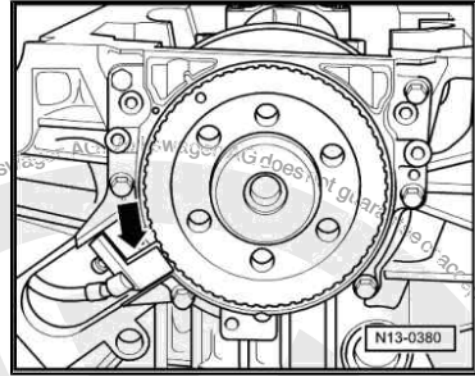
- Pull off fitter.
- Tighten sealing flange securing bolts using alternate sequence. Tightening torque: 10Nm.



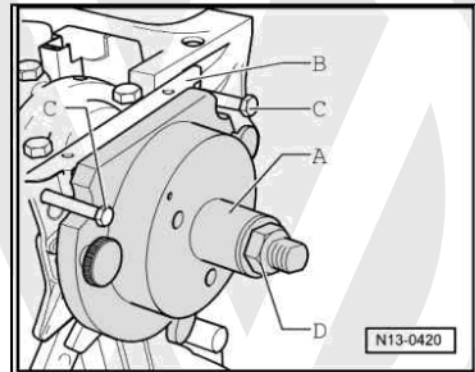


- Install engine rotation sensor -arrow-. Tightening torque: 5Nm.
- Install oil sump ⇒ [page 65](#) .
- Install intermediate plate.
- Install flywheel with new bolts.

F-Compress sensor rotor a bit more



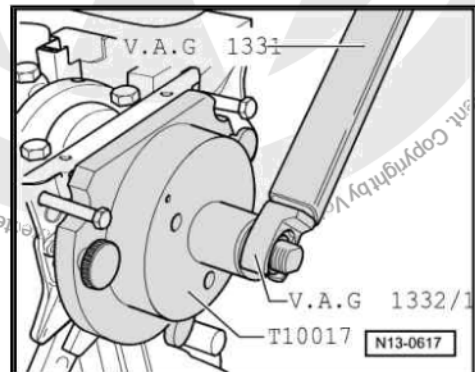
- Manually remove assembly body -A- in direction of flange -B-.
- Tighten the two M6×35mm bolts -A- to guide flange-B- on the engine block.
- Manually tighten six-sided nut -D- on the threaded piece until it seats on the assembly body -A-.



- Tighten fitter six-sided nut with torque wrench -V.A.G 1331- and key -V.A.G 1332/11- . Tightening torque: 40Nm.
- Check again assembly position of rotor on the crankshaft ⇒ [page 28](#) .

If distance -a- is too small:

- Tighten six-sided nut of fitter at 45Nm once more.
- Check again assembly position of rotor on the crankshaft ⇒ [page 28](#) .







### 3 Removing and installing crankshaft



#### Note

- ♦ To carry out assembly operations, engine must be fixed with engine and transmission bracket -VW 540- on the installation stand.
- ♦ All housing and bearing surfaces must be lubricated with oil before assembly operations.

#### 1 - Dragging element

- ☐ For oil pump drive.
- ☐ Lubricate with oil before installing oil pump.

#### 2 - Bearing shells 1, 2, 3, 4 and 5

- ☐ Classification for ordering spare parts  
⇒ [page 32](#).
- ☐ For bearing cap without oil groove.
- ☐ For cylinder block with oil groove.
- ☐ Do not mix used bearing shells if they are to be reused (mark them).

#### 3 - 65Nm

- ☐ Renew.

#### 4 - Bearing cap

- ☐ Bearing cap 1: Pulley side.
- ☐ Bearing cap 3: Bearing cap 3 with recesses for thrust washers.
- ☐ Bearing caps retainers, bearing cap/block must be leaning against each other.

#### 5 - Bearing shell 3

- ☐ ⇒ [Item 2 \(page 31\)](#)
- ☐ do not mix used bearing shells if they are to be reused (mark them).

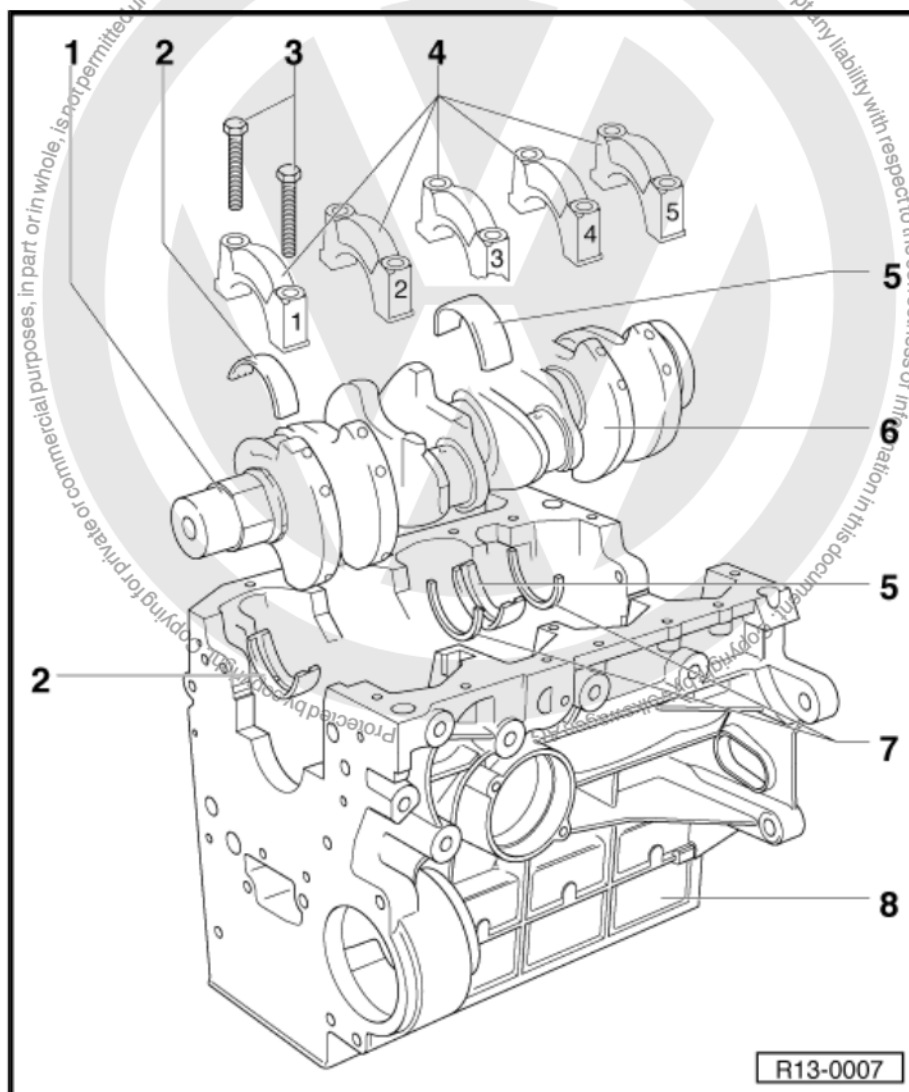
#### 6 - Crankshaft

- ☐ Axial clearance new: 0.07...0.17mm wear limit: 0.25mm.
- ☐ Measure radial gap with Plastigage: new: 0.03...0.08mm wear limit: 0.17mm.
- ☐ Do not rotate crankshaft when checking radial clearance.
- ☐ Crankshaft dimensions ⇒ [page 32](#).

#### 7 - Adjusting ring

- ☐ For cylinder block, bearing 3.

#### 8 - Engine block



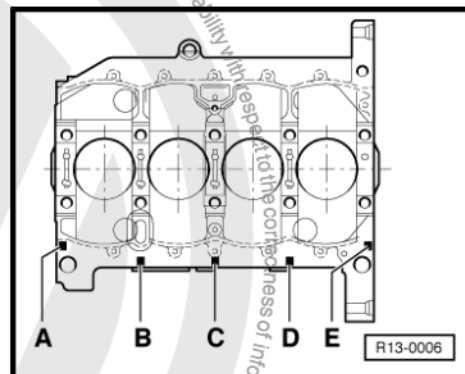


### 3.1 Identification of engine bearing shells

- Crank shaft bearing shells come classified and marked on engine block and crankshaft, as shown in the figure. To identify bearing shells the sump must be removed, so that coloured code may be read.

#### 3.1.1 Crankshaft upper bearing shell identification

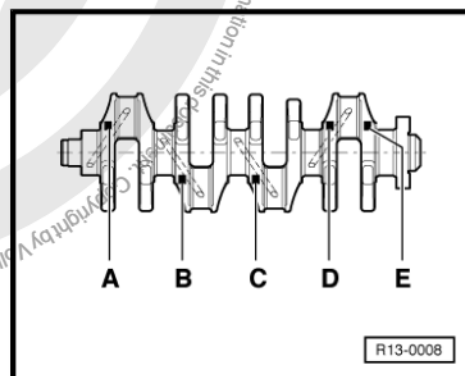
A	=	Code for bearing shell 1
B	=	Code for bearing shell 2
C	=	Code for bearing shell 3
D	=	Code for bearing shell 4
E	=	Code for bearing shell 5



#### 3.1.2 Crankshaft lower bearing shell identification

Crankshaft lower bearing shell identification for engine block and in flywheel fixation surface, letter -E-.

A	=	Code for bearing shell 1
B	=	Code for bearing shell 2
C	=	Code for bearing shell 3
D	=	Code for bearing shell 4
E	=	Code for bearing shell 5



### 3.2 Colour codes

R	=	red
G	=	yellow
B	=	Blue

### 3.3 Crankshaft dimensions

(dimensions in mm)

Grinding dimension	Crank shaft bearings Journal $\varnothing$	Conrod bearing Neck $\varnothing$
Basic dimension	-0.022 54.00 -0.037	-0.022 47.80 -0.037
First grinding	-0.022 53.75 -0.037	-0.022 47.55 -0.037
Second grinding	-0.022 53.50 -0.037	-0.022 47.30 -0.037
Third grinding	-0.022 53.25 -0.037	-0.022 47.05 -0.037



## 4 Removing and installing pistons and conrods



### Note

*All housing and bearing surfaces must be lubricated with oil before assembly operations.*

#### 1 - Piston

- ☐ Checking ⇒ [page 34](#)
- ☐ Mark installation position and cylinder number.
- ☐ Arrow on piston crown points to pulley end.
- ☐ Assemble with piston rings tension belt.

#### 2 - Piston pin

- ☐ In case removal is difficult, heat piston to 60°C.
- ☐ Remove and install with -10-206-.

#### 3 - Piston pin retaining ring

#### 4 - Conrod

- ☐ Renew- only in pairs.
- ☐ Mark relation to cylinder -A-.
- ☐ Installation position: Markings B- point to fly-wheel side.
- ☐ Pistons/conrod axial gap: 0.20...0.40mm wear limit 0.50mm.

#### 5 - Bearing shell

- ☐ Respect assembly position.
- ☐ Do not mix used bearing shells.
- ☐ Insert bearing shells centrally.
- ☐ Measure radial gap with Plastigage: new: 0.020...0.061mm wear limit: 0.091mm. Do not rotate crankshaft when checking radial clearance.

#### 6 - Engine block

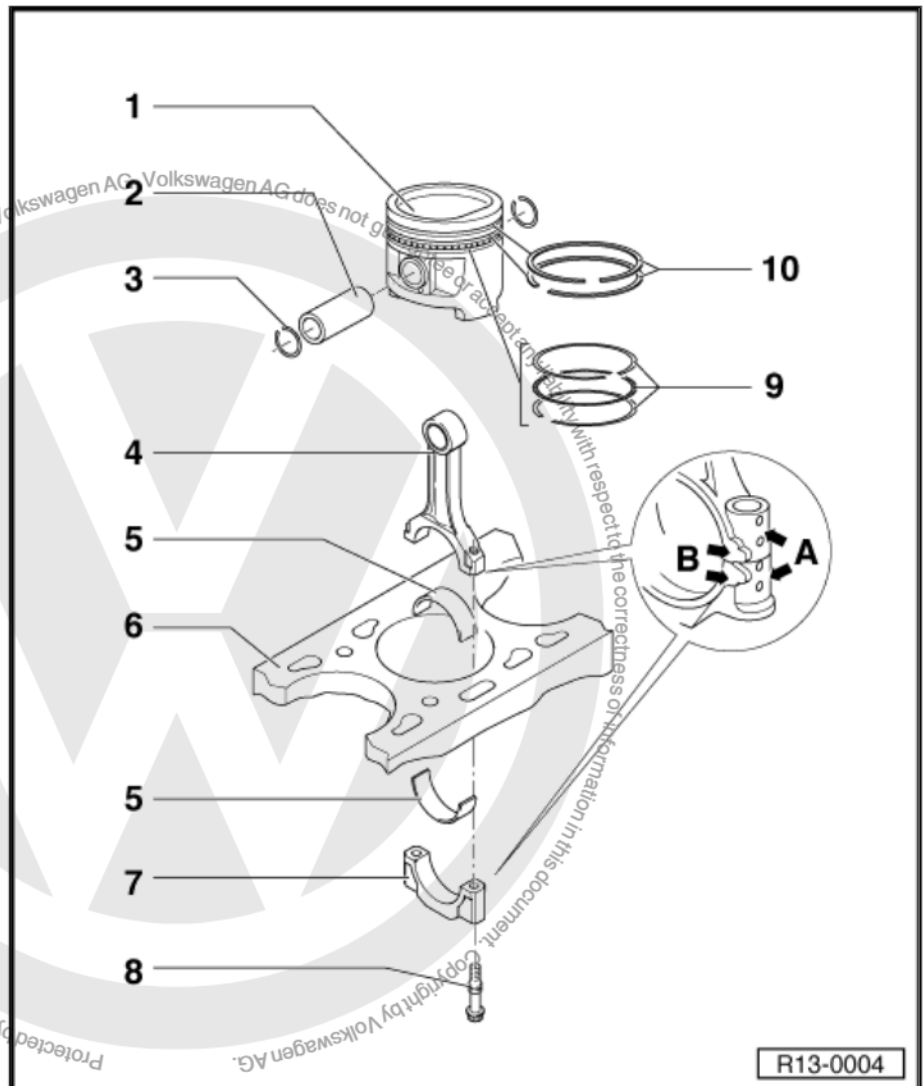
- ☐ Check cylinder diameters ⇒ [page 35](#)
- ☐ Piston and cylinder dimensions ⇒ [page 35](#).

#### 7 - Conrod cap

- ☐ Respect assembly position.
- ☐ Thanks to breaking process used for conrods, cap can only be assembled in one position and only in the respective conrod.

#### 8 - Conrod bolt, tighten with 30Nm + 90°

- ☐ Renew.





- ☐ Lubricate threads and leaning surfaces.
- ☐ Tighten with 30Nm to measure radial gap, but do not continue turning.

#### 9 - Oil scraper ring

- ☐ Remove and install carefully, manually, oil scraper rings formed by 3 parts.
- ☐ "TOP" indication must point toward piston head.
- ☐ Checking ring gap ⇒ [page 34](#)
- ☐ Checking ring to groove gap ⇒ [page 34](#)

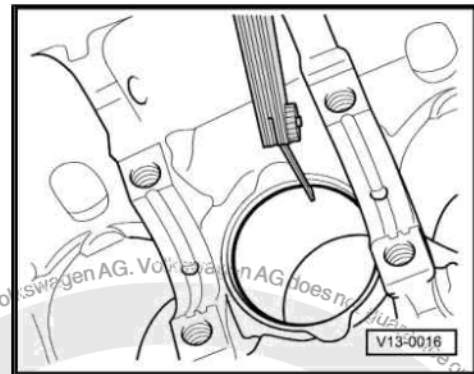
#### 10 - Compression rings

- ☐ Tilted 120°.
- ☐ Remove and install compression segment rings using compression ring pliers.
- ☐ "TOP" indication must point toward piston head.
- ☐ Check ring gap openings ⇒ [page 34](#)
- ☐ Checking ring to groove gap ⇒ [page 34](#)

#### Checking piston ring openings

- Place segment ring from above, so that it is in right angle on cylinder bottom opening, at distance of approx. 15mm to cylinder edge.

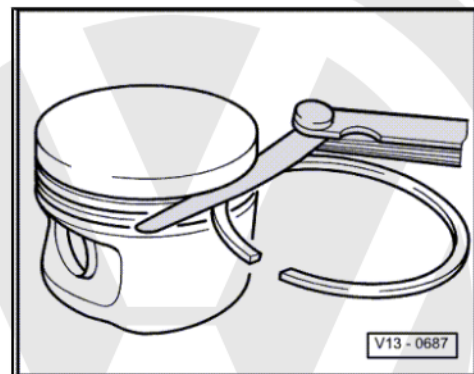
Piston ring	Wear limit
1. Compression ring	1.0mm
2. Compression ring	1.0mm
Oil scraper ring	1.0mm



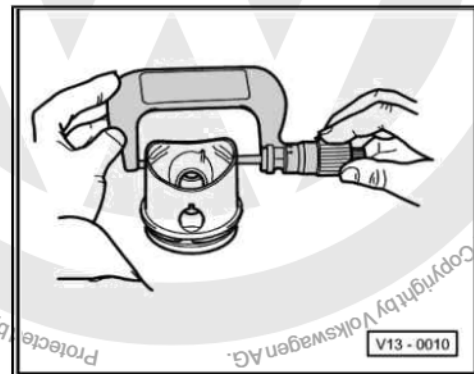
#### Checking ring to groove gap

Clean groove before checking.

Piston ring	Wear limit
1. Compression ring	0.25mm
2. Compression ring	0.15mm
Oil scraper ring	0.15mm



#### Checking piston



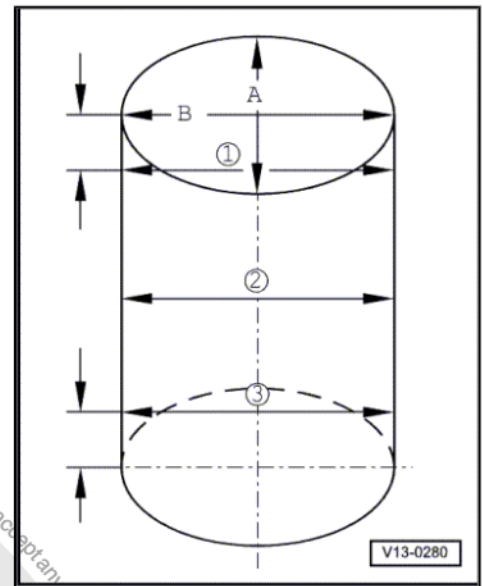
Special tools and workshop equipment required



◆ External micrometer 60...90mm

- Measure at approx. 10mm from lower corner, moved 90° in relation to piston pin axle. Nominal dimension divergence max. 0.07mm. Nominal measurement ⇒ [page 35](#) ; Pistons and cylinder dimensions

Check cylinder diameter



Special tools and workshop equipment required

◆ Internal pressure micrometer 50...100mm

- Measure at 3 locations in both directions -A- across the engine and -B- in line with crankshaft. Nominal dimension divergence max. 0.08mm. Nominal measurement ⇒ [page 35](#) ; Pistons and cylinder dimensions



Note

Cylinder diameter measurement cannot be made when engine block is fixed on assembly stand -VW 540-, as that may lead to incorrect results.

## 4.1 Piston and cylinder dimensions

Grinding dimension		Piston-Ø <sup>4)</sup>	Piston-Ø <sup>4)</sup>	-Ø cylinder interior
Manufacturer		Mahle	KS Pistons	
Basic dimension	mm	76.465	76.475	76.51
Grinding machine I	mm	76.715	76.725	76.76
Grinding machine II	mm	76.965	76.975	77.01
Grinding machine III	mm	77.215	77.225	77.26

4) Dimension data refer to non-coated pistons. Pistons with coating on measuring points may be up to 0.030mm larger Ø, depending on mileage.





## 15 – Cylinder head, Valve gear

### 1 Assembling and dismantling head

Check compression ➔ [page 48](#) .



#### Note

- ◆ When installing used head, all contact surfaces between support elements, tappets and camshaft bearings must be lubricated before the head is installed.
- ◆ The plastic packing pieces for protecting the open valves must not be removed until immediately before fitting cylinder head.
- ◆ If the cylinder head is replaced, all the coolant in the system must also be renewed.

#### 1 - Tighten with 20Nm + 90°

- ☐ Renew.
- ☐ To loosen and tighten, camshaft sprocket with special wrench -3036- .

#### 2 - Camshaft sprocket

- ☐ Ensure fastening when installing.
- ☐ Observe installation position when installing toothed belt ➔ [page 40](#) .

#### 3 - 10Nm

- ☐ Apply with D/00600/A2/.

#### 4 - Rear manual gearbox guard

#### 5 - Head cap

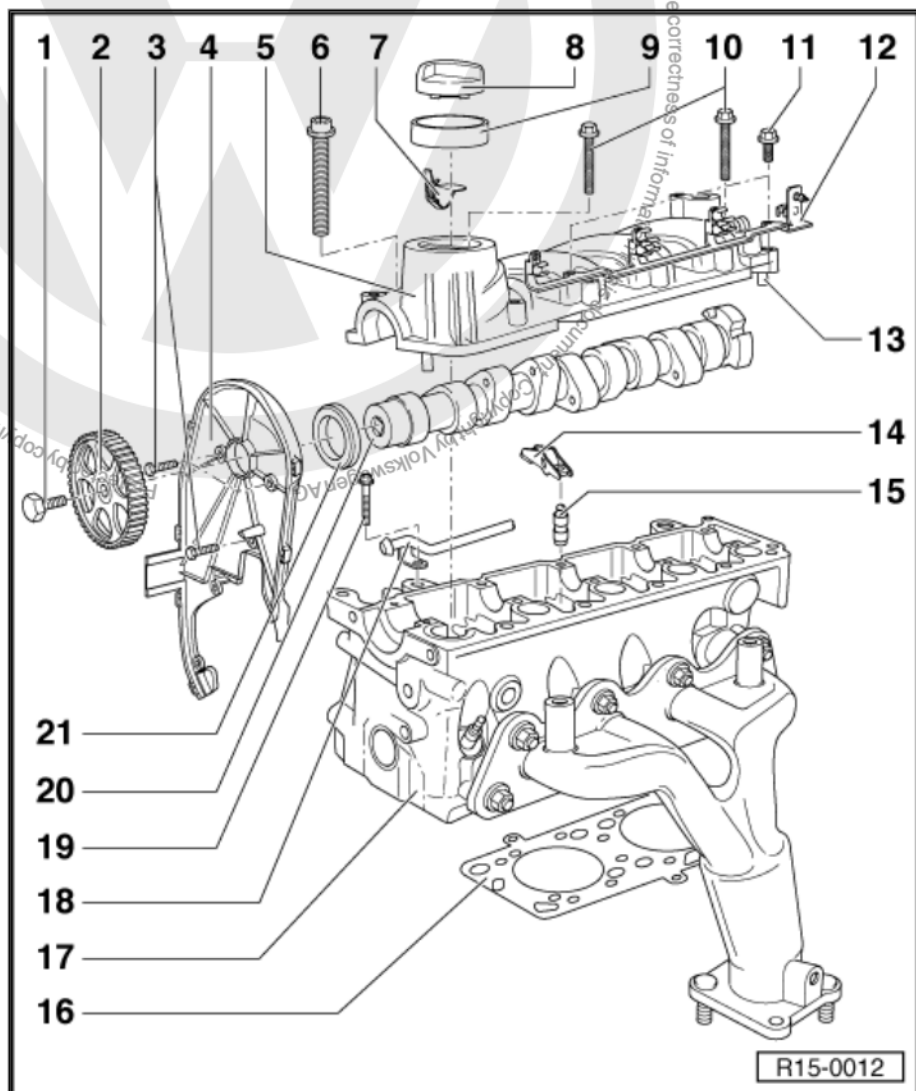
- ☐ Sealing surfaces cannot be ground.
- ☐ Integral camshaft bearings.
- ☐ Remove all seal residues.
- ☐ Apply AMV 188 001 02 before positioning.
- ☐ To assemble, place it vertically from above with pins on head holes.
- ☐ Removing and installing ➔ [page 57](#) .

#### 6 - Cylinder head bolt

- ☐ Renew.
- ☐ Follow assembly instructions and the loosening/tightening order ➔ [page 44](#) .

#### 7 - Cover

- ☐ Respect assembly position.



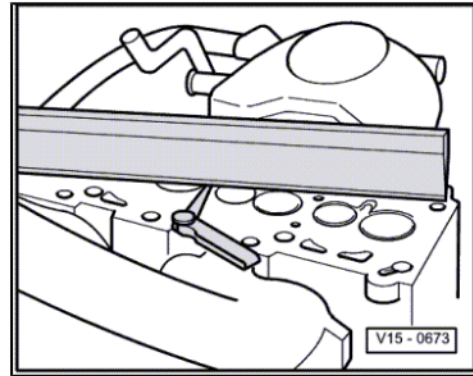


- ☐ Must be geared or ungeared.
- 8 - Oil supply cover
  - ☐ Renew damaged seal.
- 9 - Trim
  - ☐ Renew if damaged.
- 10 - Tighten with 6Nm + 90°
  - ☐ Renew.
  - ☐ Follow assembly instructions and the loosening/tightening order ⇒ [page 57](#) .
- 11 - 10Nm
- 12 - Bracket
  - ☐ For ignition cables.
- 13 - Woodruff key
- 14 - Rockers with rollers
  - ☐ Check roller bearing.
  - ☐ Lubricate rolling surface with oil.
  - ☐ For installation place securing clips over support elements.
- 15 - Support element
  - ☐ Do not interchange!
  - ☐ With hydraulic valve clearance compensation.
  - ☐ Lubricate rolling surface with oil.
- 16 - Head sealing gasket
  - ☐ Metallic gasket.
  - ☐ Renew.
  - ☐ After replacement renew the entire coolant.
- 17 - Engine head
  - ☐ Do not grind the sealing surface on camshaft side.
  - ☐ Check warpin ⇒ [page 38](#)
  - ☐ After replacement renew the entire coolant.
  - ☐ Removing and installing ⇒ [page 44](#) .
- 18 - Coolant pipe
  - ☐ Coolant hose connections diagram ⇒ [page 76](#) .
- 19 - 25Nm
- 20 - Camshaft
  - ☐ Servicing camshaft ⇒ [page 51](#) .
  - ☐ Removing and installing ⇒ [page 57](#) .
- 21 - O-ring
  - ☐ Do not additionally oil or grease the seal sealing lip.
  - ☐ Renew ⇒ [page 56](#) .

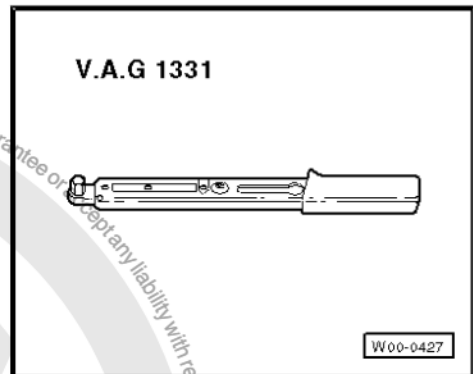


Check whether there is warping on the head

Max. permissible warping: 0.05mm.



## 1.1 Checking semi-automatic tension pulley of toothed belt



Special tools and workshop equipment required

- ◆ Torque wrench (5...50Nm) -V.A.G 1331-

Test sequence

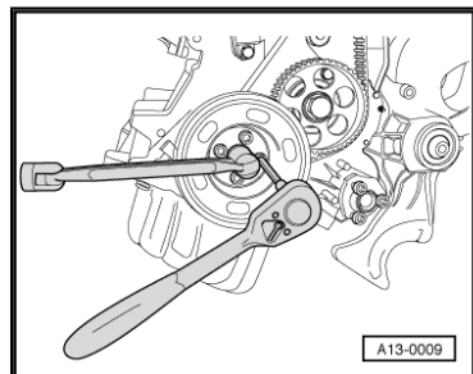
- Remove air cleaner body ⇒ [page 115](#) .
- Remove lower engine compartment anti-noise.
- Remove protection from right front wheel housing ⇒ Rep. Gr. 66 ; Removing and installing wheel housing liner
- Mark Poly-V belt operation direction and remove ⇒ [page 16](#) , Poly-V belt removal and installation.
- Take heat deflector off the exhaust collector.

Vehicles with air conditioning

- Remove Poly-V belt tension pulley.

Continuation for all vehicles

- Remove crankshaft pulley.
- Remove mechanical distribution upper and lower cover.
- Fully turn crankshaft twice in the direction of engine rotation, until engine is again on cylinder 1 upper neutral position.







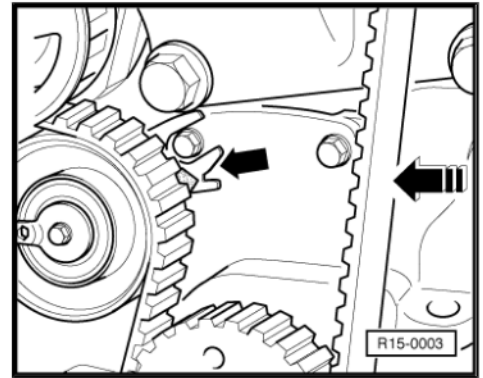
- Memorize position of tension pulley indicator -arrow-. Press toothed belt with thumb. Indicator arm must-move.
- Slightly loosen toothed belt.
- Turn crankshaft two turns in engine rotation direction.
- Then check indication arm position. It must go back to original position.

If it does not go back to original position:

- Renew belt tensioner.

If belt tensioner is OK:

- Install mechanical distribution upper and lower cover.
- Install crankshaft pulley (attention to the fastening): Tightening torque: 20Nm.



Vehicles with air conditioning

- Install tensioning element for Poly-V belt. Tightening torque  
M8: Tighten with 20Nm + 90° M10: 45Nm.

Continuation for all vehicles

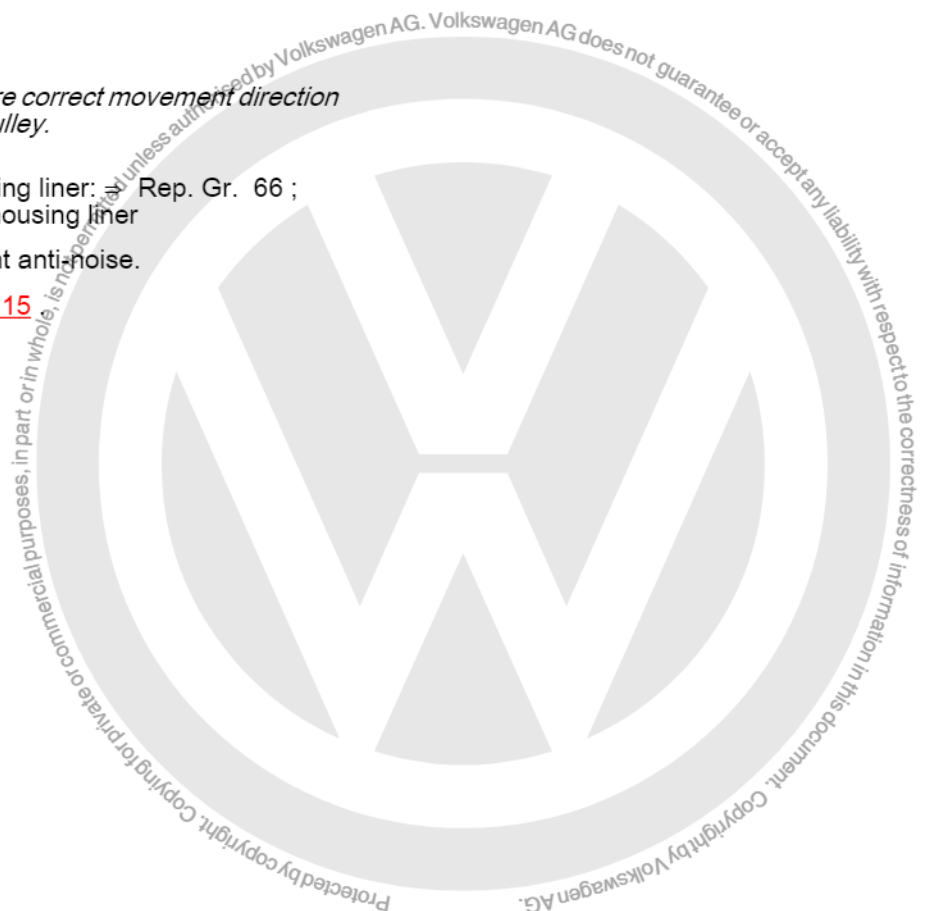
- Install exhaust collector heat deflector. Tightening torque: 10Nm.
- Install Poly-V belt ➔ [page 16](#) .



#### Note

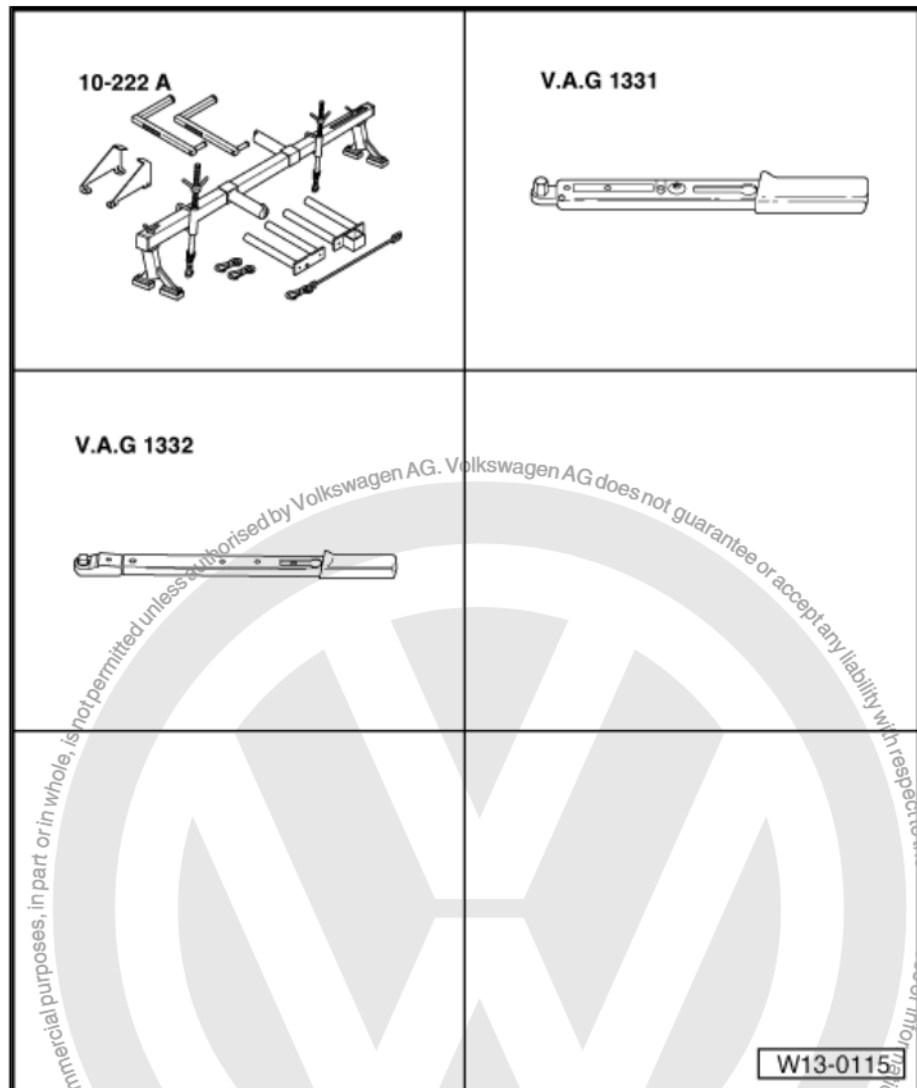
*During Poly-V belt installation-ensure correct movement direction and proper seating of belt on the pulley.*

- Install the front right wheel housing liner: ➔ Rep. Gr. 66 ;  
Removing and installing wheel housing liner
- Install lower engine compartment anti-noise.
- Install air cleaner body ➔ [page 115](#)





## 1.2 Removing, installing and adjusting toothed belt



(Adjust control times)

Special tools and workshop equipment required

- ◆ Supporting device -10-222A-
- ◆ Torque wrench (5...50Nm) -V.A.G 1331-
- ◆ Torque wrench (40...200Nm) -V.A.G 1332-

No figure

- ◆ Lifting eye Replacement part no. -SJ 403 0103 390 F- (belt pulley side)
- ◆ Six-sided key

### 1.2.1 Removing

- Remove air cleaner body ⇒ [page 115](#) .
- Remove protection from right front wheel housing ⇒ Rep. Gr. 66 ; Removing and installing wheel housing liner
- Mark Poly-V belt operation direction and remove it ⇒ [page 16](#) , Removing and installing Poly-V belt.



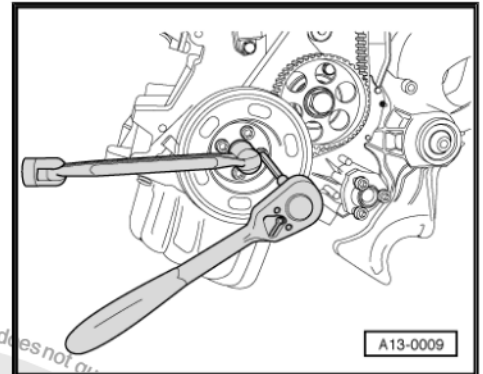
- Take heat deflector off the exhaust collector.

Vehicles with air conditioning

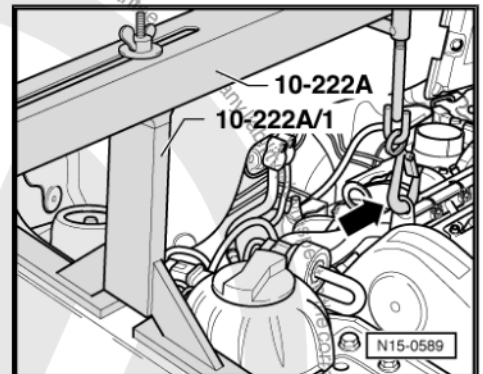
- Remove Poly-V belt tension pulley.

Continuation for all vehicles

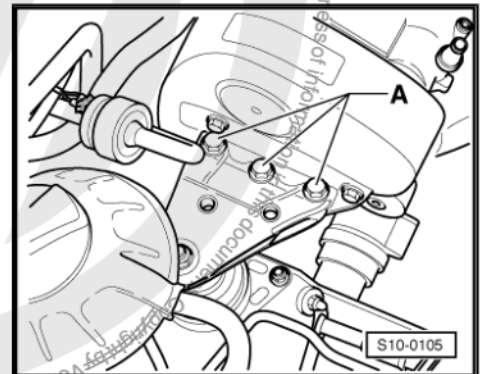
- Remove mechanical distribution upper guard.
- Remove crankshaft pulley.
- Remove mechanical distribution lower guard.
- Loosen coolant tubes from engine head.
- Install suspension holes on coolant pipes location on the head.  
Tightening torque: 25Nm



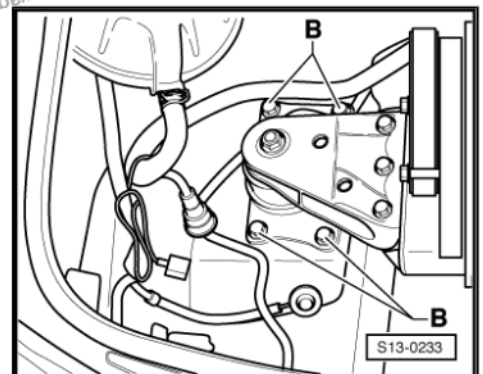
- Fit the support device -10-222A- as shown in the figure and fit the engine in installation position.
- Remove coolant tank (coolant hoses remain connected).



- Fasten engine a little and loosen securing bolts -A-.



- Remove securing bolts -B- and remove complete aggregated mounting.
- Remove engine mounting on cylinder block.
- Mark belt operation direction.
- Loosen belt tensioner and remove toothed belt.





## 1.2.2 Installing

### Prerequisites

- Engine must be at most warm.
- Pistons must not be in upper neutral position.

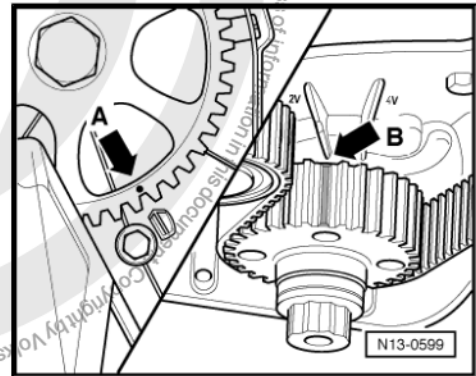


### Note

*Turning camshaft, valves may hit pistons which are in upper neutral position.*

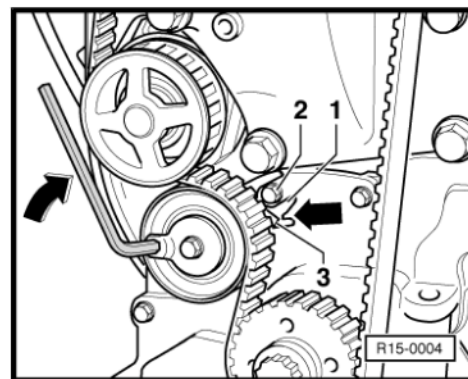
### Work sequence

- Place camshaft sprocket on the mark -arrow A-.
- Place crankshaft in cylinder upper neutral position 1. Tooth marked on the crankshaft sprocket must meet the marking -2V- on the flange -arrow B-.
- Install toothed belt. On used toothed belts, check operation direction.





- Manually tighten belt tensioner securing bolt. Carving on the base plate -1- must reach above the securing bolt -2-.
- Stretch toothed belt turning belt tensioner in arrow direction until indicator -3- is on the mark on the base plate -arrow-.
- Manually tighten belt tensioner securing bolt. Tightening torque: 20Nm
- Fully turn crankshaft twice in the direction of engine rotation, until engine is again on cylinder 1 upper neutral position.
- Then, check again the toothed belt adjusting and belt tensioner position.
- Fit engine right mounting to cylinder block. Tightening torque: 50Nm.
- Install mechanical distribution lower cover.
- Install crankshaft pulley (attention to the fastening): Tightening torque: 20Nm.



#### Vehicles with air conditioning

- Install Poly-V belt tension pulley. Tightening torque M8: Tighten with 20Nm + 90° M10: 45Nm.

#### Continuation for all vehicles

- Install exhaust collector protection plate. Tightening torque: 10Nm.
- Install engine agregado housing. Tightening torque  
⇒ [page 10](#) .
- Install toothed belt guard centre section.
- Install Poly-V belt ⇒ [page 16](#) .



#### Note

*During Poly-V belt installation-ensure proper seating of belt on the pulley.*

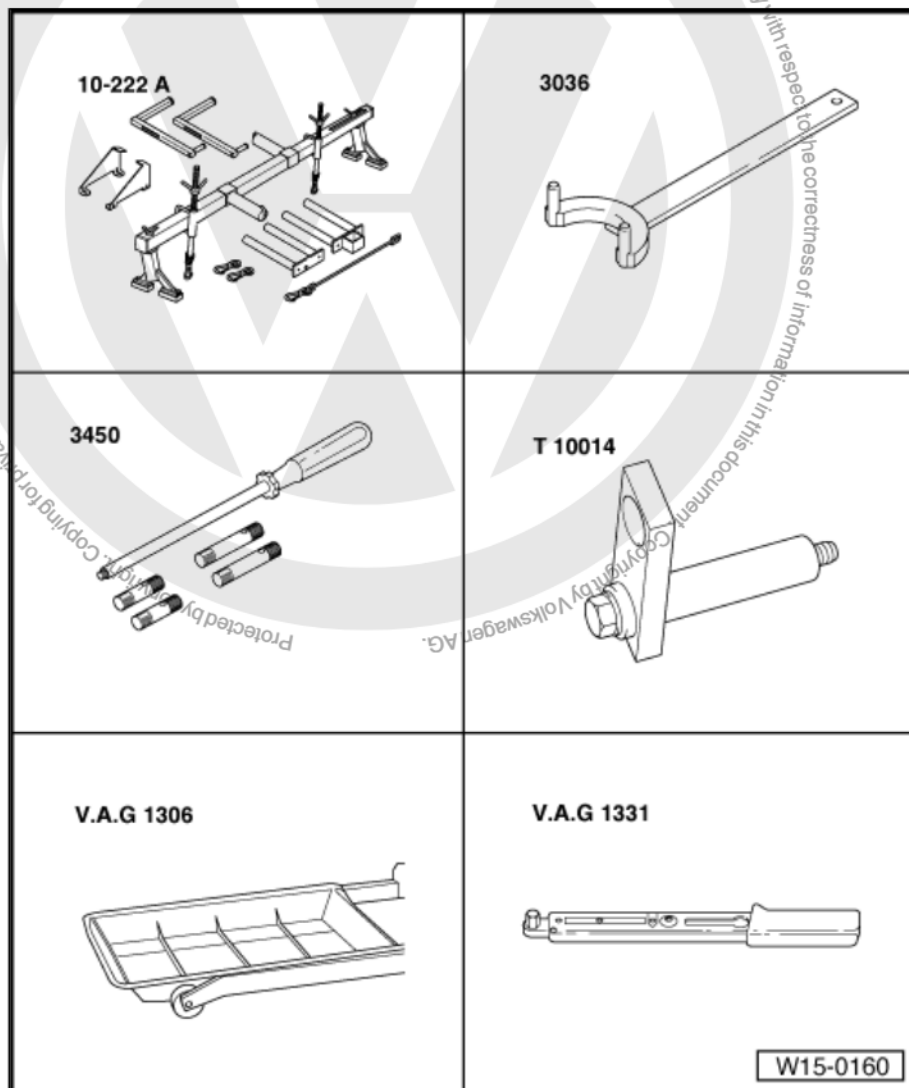
- Install the front right wheel housing liner: ⇒ Rep. Gr. 66 ; Removing and installing wheel housing liner
- Install lower engine compartment anti-noise.
- For coolant container.
- Screw engine head holding hole.
- Install coolant pipes on engine head. Tightening torque: 25Nm.
- Install air cleaner body ⇒ [page 115](#) .



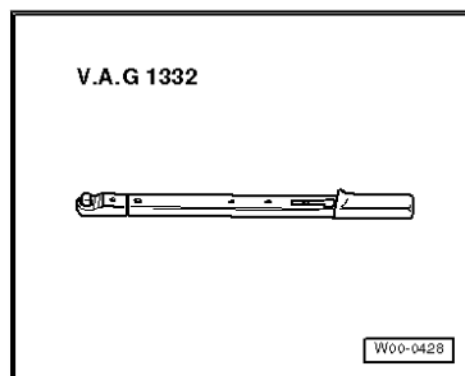
## 1.3 Removing and installing head

### Special tools and workshop equipment required

- ◆ Supporting device -10-222A-
- ◆ Star wrench -3036-
- ◆ Guides -3450-
- ◆ Support -T10014-
- ◆ Oil collector -V.A.G 1306-
- ◆ Torque wrench (5...50Nm) - V.A.G 1331-



No figure

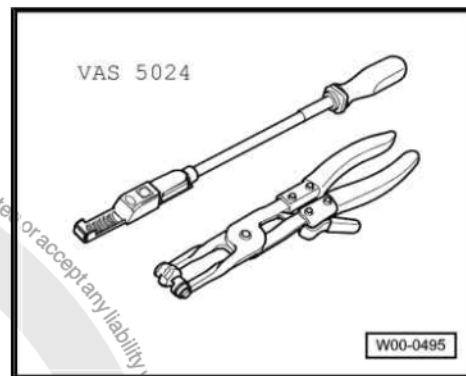




- ◆ Suspension hole Replacement part no. -SJ 403 0103 390 F- (belt pulley side)
- ◆ -V.A.G 1332- Torque wrench (40...200Nm)
- ◆ -VAS 5024- Assembly tool for springtype clips

#### Initial conditions

- Engine may be at most warm



### 1.3.1 Work sequence



#### Note

*Battery earth strap must be disconnected during jobs. First, check if a code radio equipment is installed. If necessary, consult anti-theft code beforehand.*

- With ignition switched off disconnect battery earth strap.
- Remove air cleaner: ➔ [page 115](#) .
- Loosen coolant tubes from engine head.
- Install suspension holes on coolant pipes location on the head. Tightening torque: 25Nm.
- Loosen front right wheel housing liner ➔ Rep. Gr. 66 ; Removing and installing wheel housing liner
- Remove toothed belt ➔ [page 40](#) . Remove, install and adjust toothed belt.
- Remove valve camshaft sprocket to loosen bolt and hold camshaft sprocket with special tool -3036- .



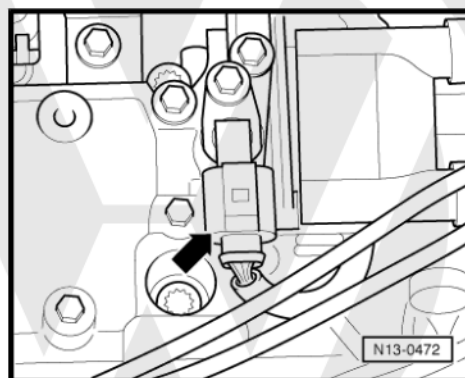
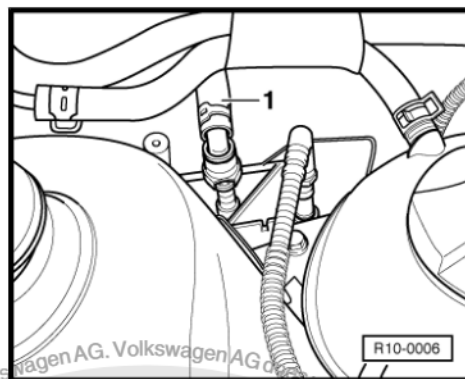
#### WARNING

*Fuel supply pipe is under pressure. Before loosening hose joints place a cloth around them. Then depressurise culling hose carefully.*



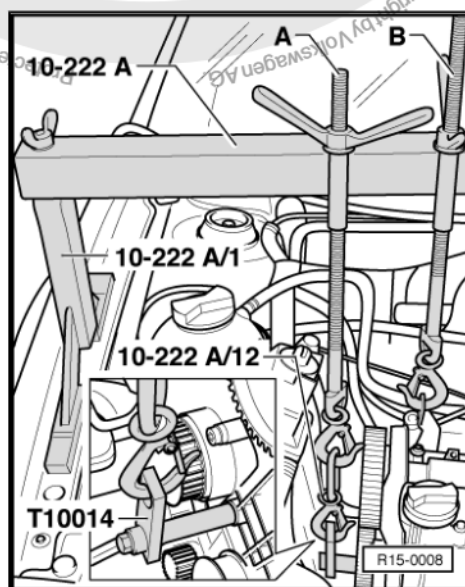


- Loosen fuel intake pipe 1 (press unlocking key).
- Loosen hose from electromagnetic valve 1 -N80- on intake collector.
- Close tubes so that no dirt enters the fuel supply system.
- Loosen or separate the following components:
  - ◆ Intake collector vacuum hose to servo-brake
  - ◆ Ignition transformer and butterfly-valve control unit fitting connector
  - ◆ Injection valves fitting connectors
  - ◆ Fitting connector of engine rotation sensor and intake collector pressure and intake air temperature sensor
  - ◆ Double connector of knock sensor (behind engine block)
  - ◆ Connector of coolant temperature sensor and oil pressure switch
- Disconnect 3-pole Hall sender connector -arrow-.
- Remove fuel delivery unit with all injectors ⇒ [page 114](#) .
- Open and close coolant container lid to release cooling system pressure.
- Drain coolant ⇒ [page 77](#) .
- Remove water pump along with mechanical distribution rear guard ⇒ [page 82](#) , Removing and installing water pump.
- Remove coolant thermostatic valve body circlip, which fastens coolant pipe to pump.
- Remove engine head thermostatic valve body.
- Disconnect all coolant, vacuum and suction hoses from engine head.
- Loosen exhaust collector exhaust pipe.
- Loosen guide tube of oil level measuring stick.
- Then raise engine a little with threaded piece -B-.

**Note**

*As the holding hole is screwed to engine head, an additional support must be installed on engine block.*

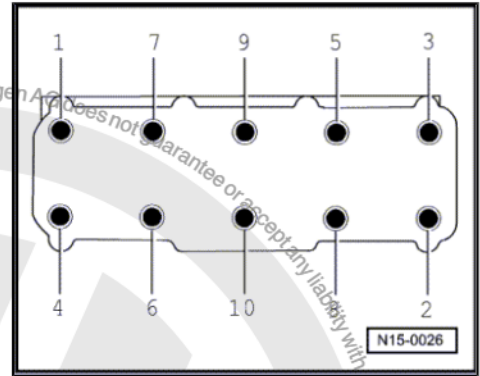
- Tighten, -as per indications-, the -T10109- bracket to threaded hole in the coolant pump area in the engine block. Tightening torque: 20Nm.
- Raise engine a little with the second threaded piece -A- until it-B- is relieved.
- Remove threaded piece -B-.







- Loosen engine head bolts in indicated sequence and remove them.
- Carefully raise engine head.

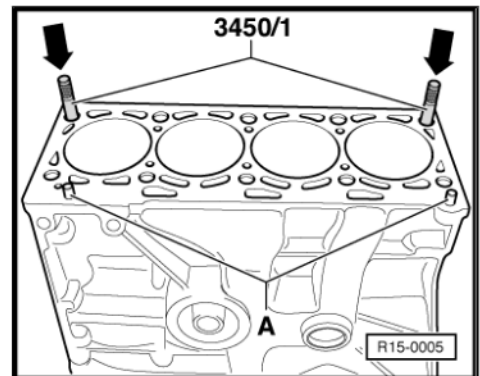


### 1.3.2 Installation



#### Note

- ◆ *Only unpack new engine head sealing gasket immediately before installation.*
- ◆ *Handle new gasket carefully. Damages may cause leaks.*
- Place a clean cloth over cylinder so that no dirt penetrates between cylinder and head.
- It also prevents dirt from falling into the coolant.
- Carefully clean engine head and engine block sealing surfaces. Ensure no scratches are made (when using emery paper, granulation never lower than 100).
- Carefully remove emery residues with a piece of cloth.
- Set cylinder 1 piston to upper neutral position and then turn crankshaft back slightly.
- To centre engine head, tighten guide pins -3450/1- onto the external rear holes of engine head bolts -arrows-.
- Install the new head sealing gasket onto centring pins -A-. The marking (spare part number) must be legible.
- Fit cylinder head, screw in 8 remaining cylinder head bolts and tighten by hand.
- Loosen guide-pins using tool -3450- , through the bolt holes. To do so, turn pin tool to the left until pins are loose.
- Fit the two remaining head bolts and tighten by hand.





- Tighten cylinder head in tightening sequence as follows:
- Tighten all bolts with 30Nm.
- Then tighten all bolts with 180° using a rigid wrench.



Note

Head screws re-tightening is not necessary after repairs.

Install in reverse order.



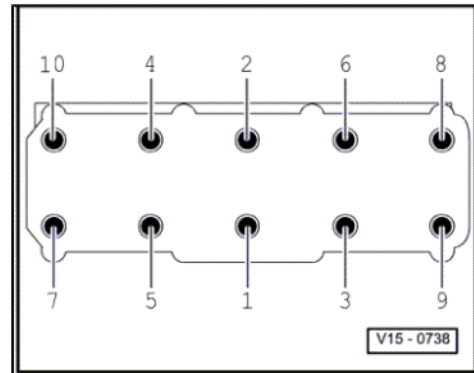
Note

When the camshaft is turned, the crankshaft must not be at upper neutral position. Danger of damage to valves or piston crowns.

How to install toothed belt and adjust control times ⇒ [page 40](#) .

Fill new coolant ⇒ [page 77](#) .

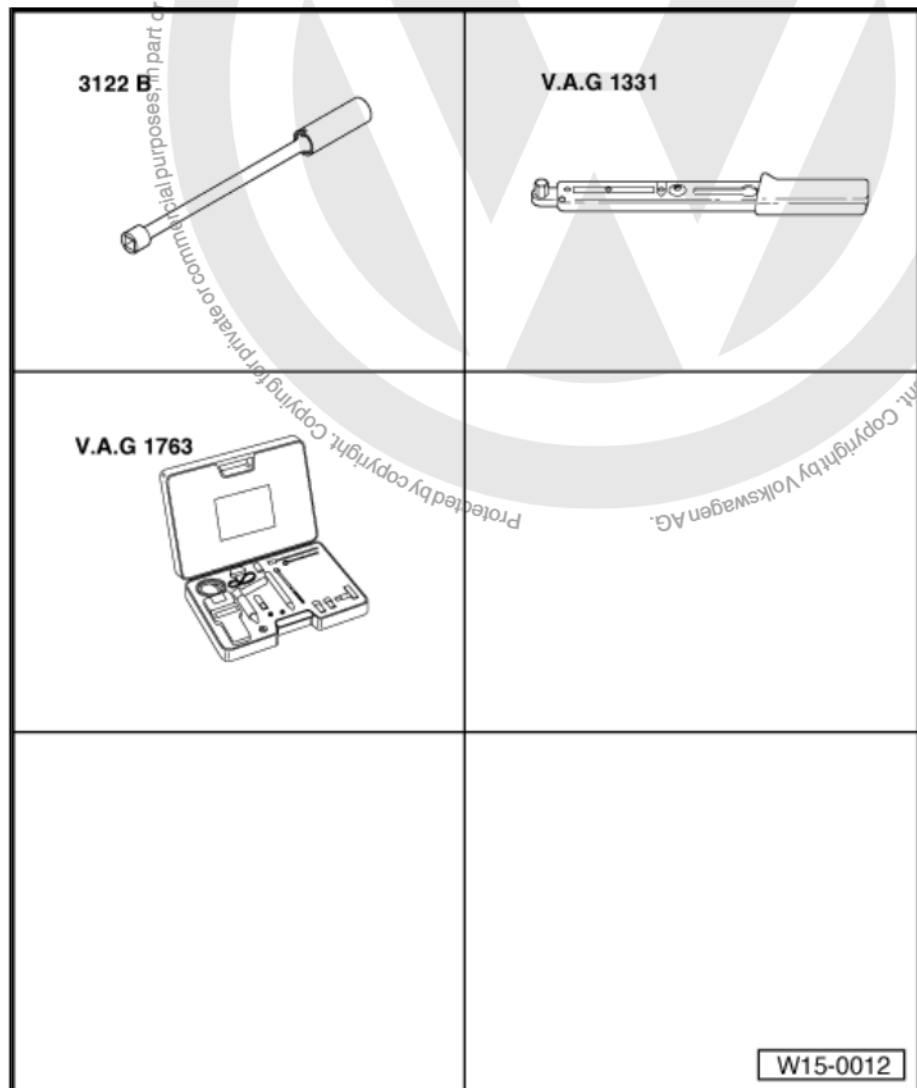
- Consult fault memory ⇒ [page 128](#) .



## 1.4 Checking compression

Special tools and workshop equipment required

- ◆ Spark plug wrench -3122B-
- ◆ Torque wrench (5...50Nm) - V.A.G 1331-
- ◆ Compression measurer -





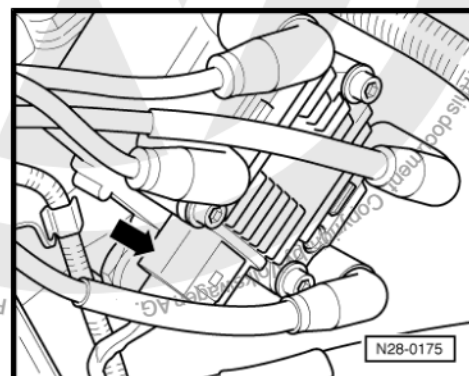
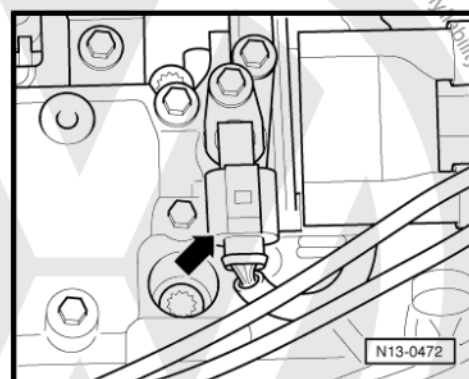
V.A.G 1763-

#### Test conditions

- Engine oil temperature must be at least 30°C.
- The battery voltage must be at least 11.5 V.
- All electric equipment, like lights and rear window heating, must be off.
- If vehicle has air conditioning, it must be off.

#### 1.4.1 Work sequence

- Remove air cleaner body ➔ [page 115](#) .
- Remove ignition spark plugs with tool -3122B- .
- Disconnect 3-pole Hall sender connector -arrow-.
- Disconnect 4-pole connector from ignition transformer -arrow-.





- Pull fuse 33 out of fuse-holder.



Note

*When fuse 33 is removed, power supply to injectors is interrupted.*

- Ask a second mechanic to step on the throttle pedal, so that butterfly valve is fully open.
- Check compression with compression checking equipment - V.A.G 1381- or V.A.G 1763- .



Note

*Charge battery according to instruction manual for battery charger.*

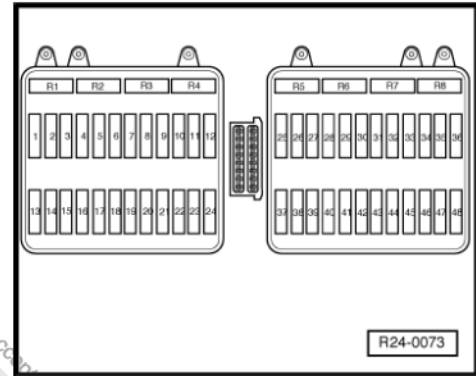
- Operate starter until tester shows no further pressure increase.

Compression pressure values:

new: 10...15 bar pressure wear limit: 7 bar pressure.

Permissible cylinder difference: 3 bar.

- Install ignition spark plugs with tool -3122B- and tighten at 30Nm torque.
- Interrogate fault memory, eliminate faults and delete fault memory ⇒ [page 128](#) .





## 2 Servicing camshaft



### Note

- ◆ *Cylinder heads which have cracks between the valve seats or between valve seat inserts and the spark plug thread can be used further without reducing service life, provided the cracks do not exceed a maximum of 0.5mm wide or the first spark plug filaments have cracks.*
- ◆ *All housing and bearing surfaces must be lubricated with oil before assembly operations.*

#### 1 - Camshaft

- ☐ Check axial gap  
⇒ [page 52](#).
- ☐ Removing and installing  
⇒ [page 57](#).
- ☐ Measure radial gap with Plastigage: Wear limit: 0.1mm.
- ☐ Excentricity: max. 0.05mm.
- ☐ Code ⇒ [page 53](#)

#### 2 - Tighten with 6Nm + 90°

- ☐ Renew.
- ☐ Follow assembly instructions and the loosening/tightening order  
⇒ [page 57](#).

#### 3 - Head cap

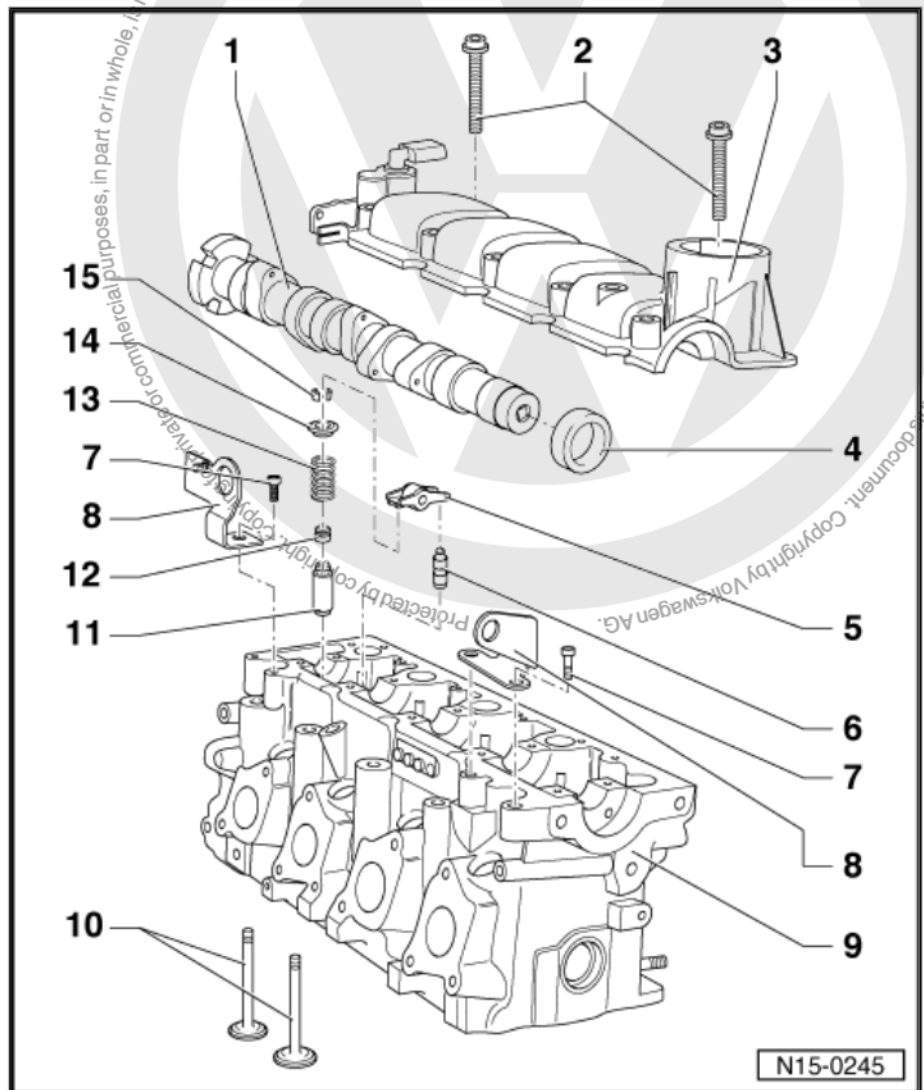
- ☐ Sealing surface cannot be ground.
- ☐ Integral camshaft bearings.
- ☐ Remove all seal residues.
- ☐ Apply AMV 188 001 02 before positioning.
- ☐ To install, place from above and vertically on engine head holes using the woodruff keys.
- ☐ Removing and installing  
⇒ [page 57](#).

#### 4 - Seal

- ☐ Do not additionally oil or grease the seal sealing lip.
- ☐ Renew ⇒ [page 56](#).

#### 5 - Rocker with roller

- ☐ Check roller bearing.
- ☐ Lubricate rolling surface with oil.
- ☐ To install, loosen circlip on the support element.





6 - Support element

- ☐ Do not interchange!
- ☐ With hydraulic valve clearance compensation.
- ☐ Lubricate rolling surface with oil.

7 - 25Nm

8 - Support/holding hole

- ☐ Spare part numbers: -SJ 403 0103 390 F- (belt pulley side) -SJ 403 0103 390 G- (inertial flywheel side).

9 - Engine head

- ☐ Do not grind the sealing surface on camshaft side.
- ☐ Grind valve seat ⇒ [page 54](#) .
- ☐ Grind sealing surface on engine block side.

10 - Valves

- ☐ Do not rework, only grinding is permitted.
- ☐ Valve dimensions ⇒ [page 53](#)

11 - Valve guide

- ☐ Check ⇒ [page 60](#) .

12 - Valve stem seal

- ☐ Renew ⇒ [page 61](#) .

13 - Valve spring

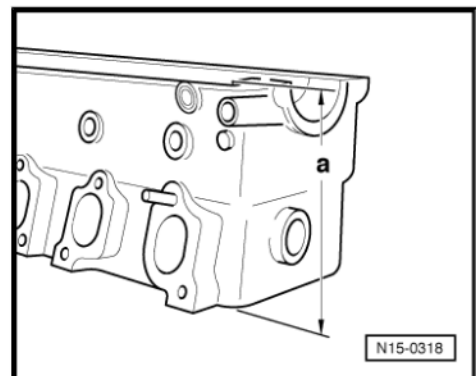
- ☐ Removal and installation: Engine head disassembled: with -2037- installed: ⇒ [page 61](#) , replace valve stem seals.

14 - Spring plate

15 - Cotteners

Grind sealing surface on engine block side

Cylinder head reworking dimension: a = at least 135.6mm.



## 2.1 Check axial gap - valve camshaft

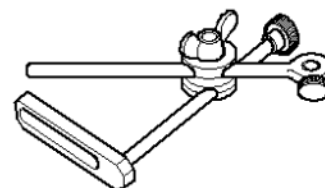
Special tools and workshop equipment required





# ◆ Brackets -VW 387-

VW 387



W00-0037

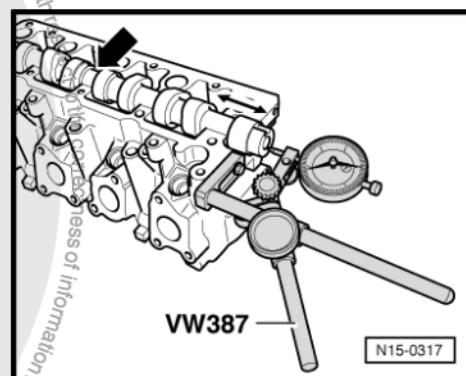
## ◆ Gauge

- Camshaft, check axial gap.

Measure when supporting elements and camshaft cover are removed.

- Press camshaft on central control bearing -arrow-, and check axial gap moving camshaft.

Wear limit: max. 0.15mm



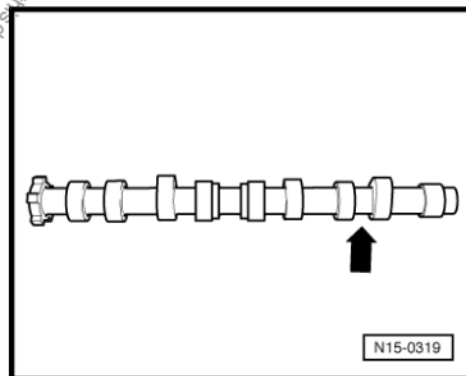
VW387

N15-0317

## Camshaft code

Code between cylinder 1 intake and exhaust cams

Cylinder 1 -arrow- 032 AF



N15-0319

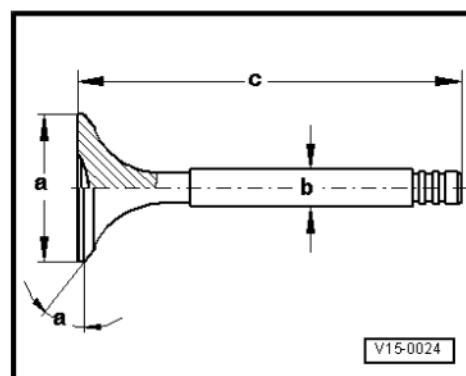
## Valve dimensions



### Note

Valves must not be reworked. Only grinding is permitted.

Dimensions		Inlet valve	Exhaust valve
Ø a	mm	34.5	28.0
Ø b	mm	5.98	5.96
c	mm	99.25	99.25
α	°	45	45



V15-0024

## 2.1.1 Distribution times for 1mm valve gap

		Intake valve	Exhaust valve
Opens after-wards	UNP	13.0°	-----



		Intake valve	Exhaust valve
Closes afterwards	PMI	38.0°	-----
Opens before	LNP	-----	49.0°
Closes before	UNP	-----	4.0°

## 2.2 Reworking valve seats

Special tools and workshop equipment required

- ◆ Depth
- ◆ Valve seat grinding machine



### Note

- ◆ In case of repairs on engines with leaking valves, grinding or renewing valves and seats is not enough. Especially in high mileage engines valve guides must be checked for wear  
⇒ [page 60](#).
- ◆ Grind valve seat only until a correct image is offered. Calculate before proceeding to maximum permissible grinding. In case the grinding measurement is surpassed, the hydraulic compensation is no longer assured and engine must be renewed.

### 2.2.1 Calculate maximum allowable grinding specification.

- Insert valve and press firmly against seat.



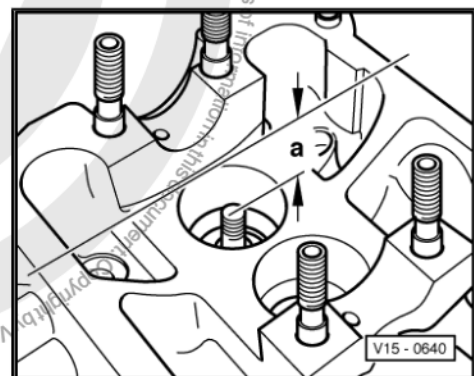
### Note

If the valve is to be renewed as part of a repair, use a new valve for the measuring.

- Measure distance -a- between end of valve stem and upper edge of cylinder head.
- Calculate maximum permissible grinding quota, based on measured distance and minimum specification.

Minimum dimensions: Intake and exhaust valve 32.1mm.

Measured distance a minus minimum dimension = Maximum permissible grinding.



### 2.2.2 Example:

- Measured distance	32.5 mm
Minimum specification	32.1 mm
= Maximum allowable grinding specification	0.4 mm

5)

5) Maximum grinding is shown in the figures to grind valve seats as dimension b.





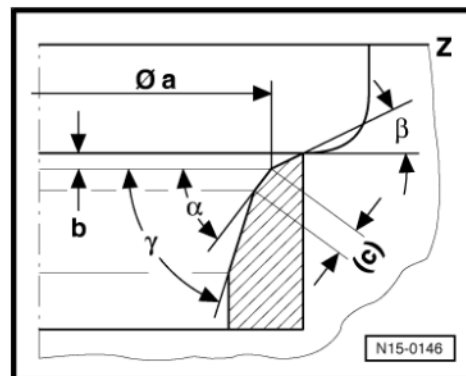
### 2.2.3 Reworking intake valve seat

- a =  $\varnothing$  32.9mm
- b = Max. permissible grinding dimension\*
- c = max. 1.8 ... 2.0mm
- Z = Engine head lower corner
- $\alpha$  = 45° Valve seat angle
- $\beta$  = 30° Upper correction angle
- $\gamma$  = 60° Lower correction angle



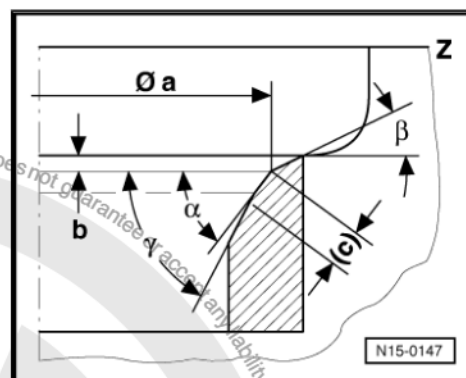
Note

*In case of narrowing valve seat rings, grinding is only permitted provided the narrowing is not damaged.*



### 2.2.4 Reworking exhaust valve seat

- a =  $\varnothing$  26.6mm
- b = Max. permissible grinding dimension\*
- c = max. 1.8 ... 2.0mm
- Z = Engine head lower corner
- $\alpha$  = 45° Valve seat angle
- $\beta$  = 30° Upper correction angle
- $\gamma$  = 60° Lower correction angle

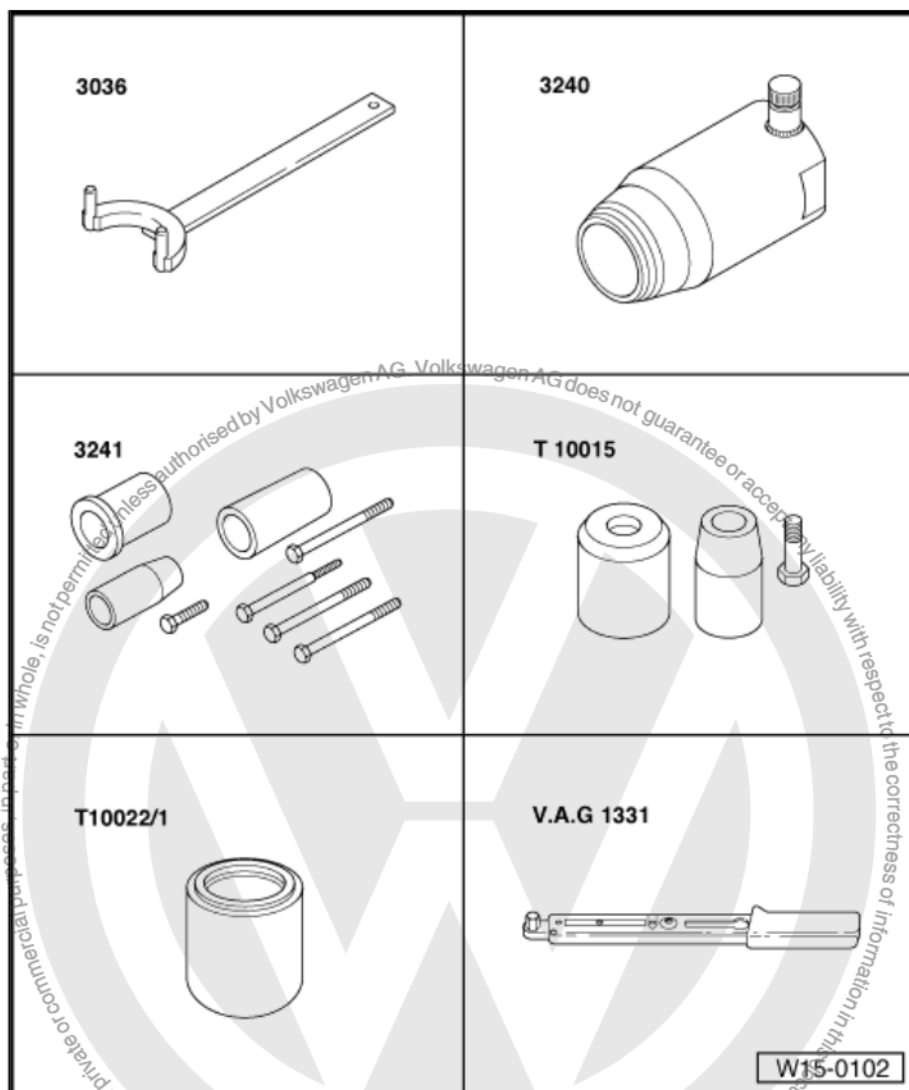




## 2.3 Renewing camshaft seal

Special tools and workshop equipment required

- ◆ Star wrench -3036-
- ◆ Puller -3240-
- ◆ Fitter sleeves -3241-
- ◆ Applying bolt -T10015/3-
- ◆ Press piece -T10022/1-
- ◆ Torque wrench (5...50Nm) - V.A.G 1331-

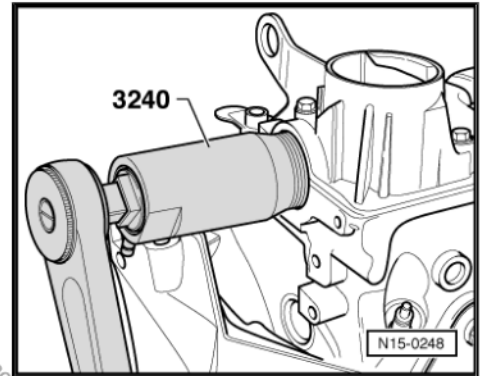


### 2.3.1 Removing

- Remove toothed belt ⇒ [page 40](#) . Removal, installation and adjusting of toothed belt.
- Remove camshaft sprocket. To loosen, hold camshaft sprocket with special tool -3036- .
- Remove mechanical distribution rear guard.
- For seal puller guide, fasten camshaft sprocket bolt manually until camshaft stop.
- Turn internal part of seal -3240- puller twice (approx. 3mm) of the external part and lock with socket head bolt.

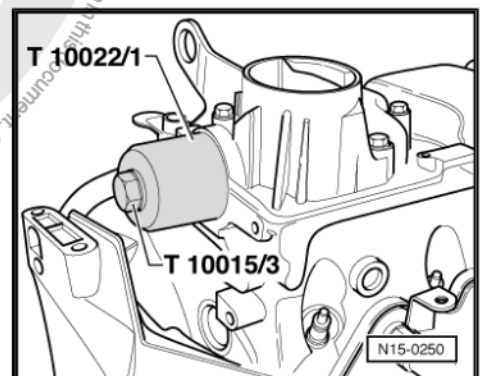
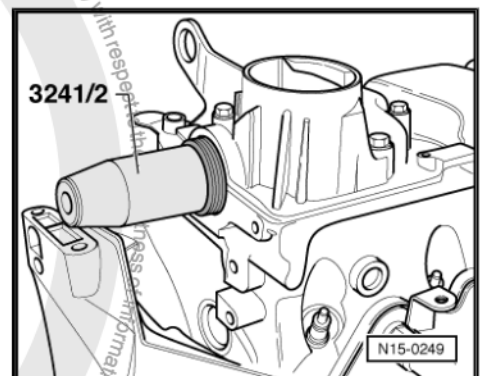


- Lubricate puller threaded head, seat it and tighten firmly onto the seal.
- Loosen socket head bolt and turn inner part against crankshaft until the oil seal is pulled out.
- Loosen camshaft sprocket securing bolt 1 turn.



### 2.3.2 Installing

- Do not additionally oil or grease the seal sealing lip.
- Place fitting sleeve -3241/2- on camshaft journal.
- Move seal through guide sleeve.
- Remove guide sleeve.
- Press seal with pressure piece -T10022/1- and -T10015/3- bolt until stop. Place a washer between pressure sleeve and six sided bolt.
- Install camshaft sprocket and tighten new bolt (use special tool -3036- ). Tightening torque: 20Nm + 90°.



Install in reverse order.

How to install toothed belt and adjust control times = [page 40](#) .

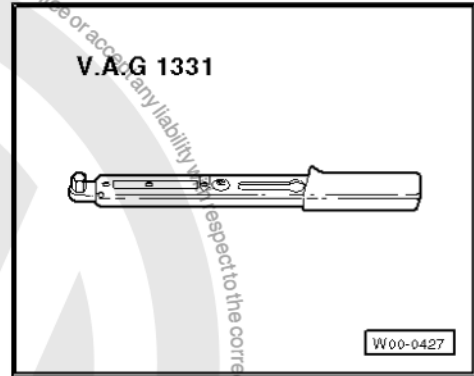
## 2.4 Removing and installing camshaft head cover

Special tools and workshop equipment required

- ◆ Star wrench -3036-



- ◆ Torque wrench (5...50Nm) -V.A.G 1331-



- ◆ AMV 188 001 02 Sealant

## 2.4.1 Removing



### Note

- ◆ *Sealing surfaces on head cover and engine head cannot be reworked.*
- ◆ *The camshaft heads are integrated with engine head and head cover. Before removing head cover, toothed belt must be loosened.*
- ◆ *When loosening head cover, camshaft seal must be renewed.*

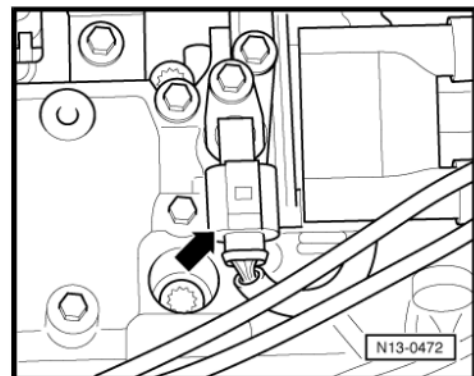
### Work sequence



### Note

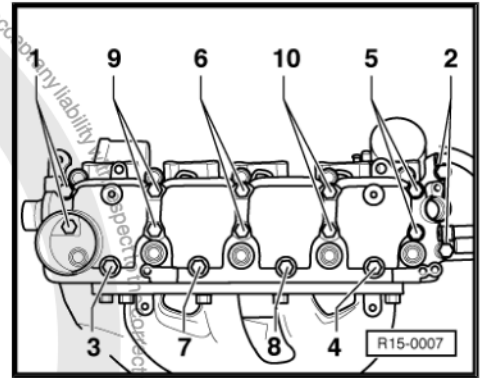
*Battery earth strap must be disconnected during jobs. First check whether a coded radio is fitted. If necessary, consult anti-theft code beforehand.*

- With ignition switched off disconnect battery earth strap.
- Take toothed belt off ⇒ [page 40](#) ; Toothed belt removing and installing, adjusting.
- Remove camshaft sprocket. To loosen and tighten, hold camshaft sprocket with special tool -3036- .
- Tighten three upper fastening bolts of mechanic distribution back cover.
- Loosen ignition transformer bolts from head cover.
- Disconnect 3-pole Hall sender connector -arrow-.
- Remove oil filling cover from head cover, disconnect and remove protector.





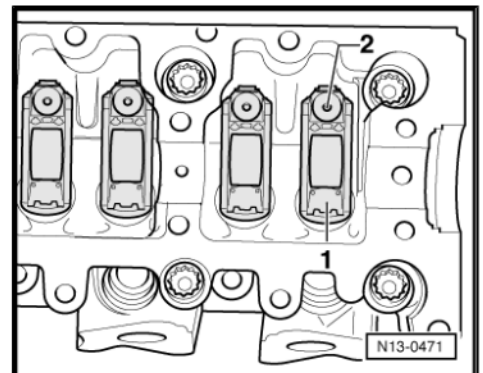
- Loosen head fastening bolts in the indicated sequence, -Pos. 9 and 10- must be loosened diagonally.
- Carefully remove head cover.
- Carefully remove camshaft through the top and place on a clean surface.
- Remove rockers, along with supporting elements and place them on a clean surface.
- Ensure rockers with rollers and supporting elements are not mixed.



## 2.4.2 Installing

### Prerequisites

- Ensure no dirt and sealant residues enter the engine head.
- Sealing surfaces must be free from oil and grease.
- During installation of head cover and camshaft cylinder 1 cams must be turned upwards.
- Pistons must not be in upper neutral position.
- Remove sealant residues on engine head and head cover with a common sealant solvent.
- Lubricate with oil the camshaft rolling surfaces.
- Fit supporting elements onto engine head and the respective rockers.
- Ensure the rockers are duly placed on valve ends -1- and respective support elements -2- are duly coupled.
- Install camshaft carefully on the engine head bearings.

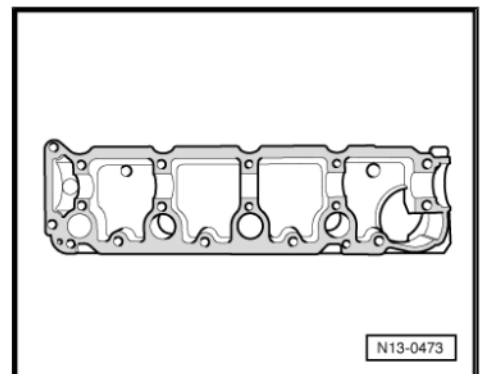


- Apply a thin and even seal layer on the clean contact surface of head cover.



### Note

*Sealant layer cannot be very thick, otherwise excess sealant may penetrate the lubricating channels the camshaft bearings, damaging the engine.*





- Carefully fit valve head cover vertically from above with guide pins onto engine head holes -arrows-.



Note

- ♦ *Fitting and fastening of head cover must be made in one single non-interrupted operation because sealing surfaces get hard as soon as they come into contact.*
- ♦ *Head cover bolts must be renewed.*

- First tighten position bolts -1 and 2- diagonally with 6Nm.
- Then, tighten other bolts as per indications with 6Nm.
- Then tighten all bolts more 90°.



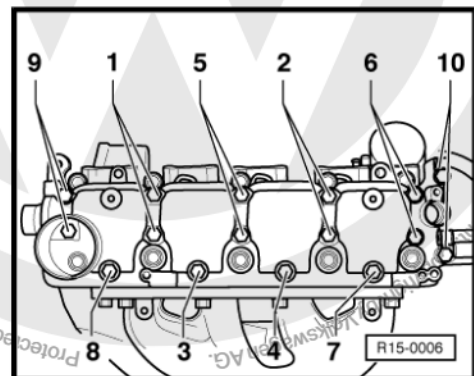
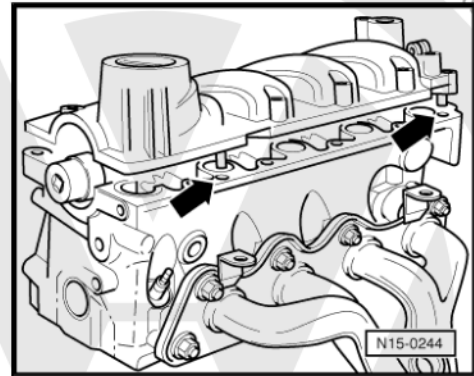
Note

After oil sump installation, seal must dry for approximately 30 minutes.

- Install new camshaft seal ⇒ [page 56](#) .

Install in reverse order.

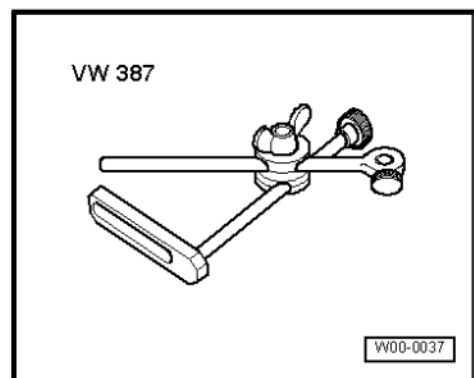
How to install toothed belt and adjust control times ⇒ [page 40](#) .



## 2.5 Checking valve guides

Special tools and workshop equipment required

- ♦ Brackets -VW 387-



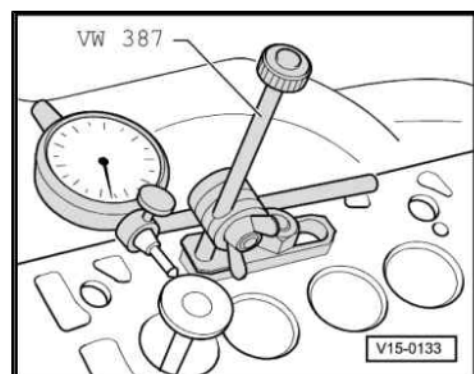
- ♦ Gauge

Test sequence

- Place a new valve on the guide. Valve rod end must be aligned with guide. As valve guides have different diameters, use-only one intake valve on the intake guide and one exhaust valve on the exhaust guide.
- Determine folding space. Wear limit: 0.8mm.

In case gap is exceeded:

- Renew engine head.

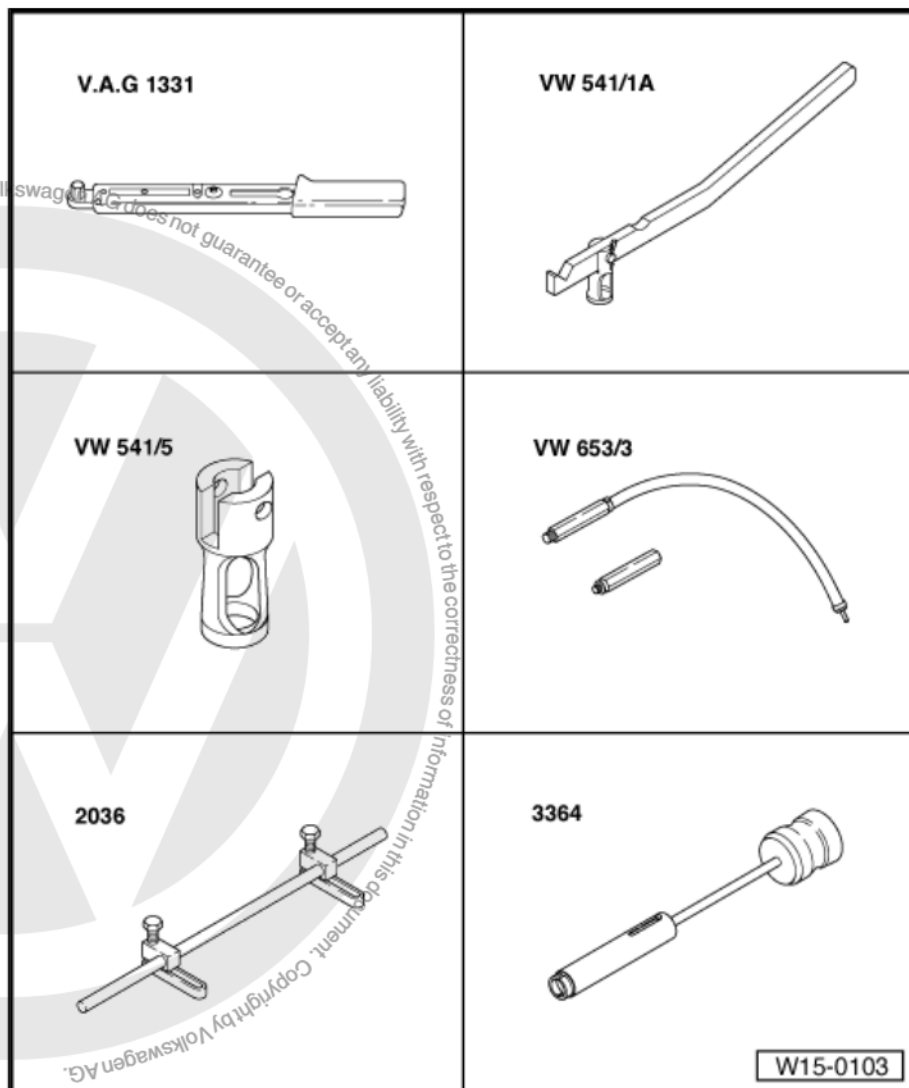






## 2.6 Renewing valve stem seal

- ◆ Torque wrench (5...50Nm) - V.A.G 1331-
- ◆ Lever -VW 541/1A-
- ◆ Press piece -VW 541/5-
- ◆ Flex pipe -VW 653/3-
- ◆ Device -2036-
- ◆ Impact puller -3364-
- ◆ Seal fitter -3365-



### 2.6.1 Removing

- Remove toothed belt ⇒ [page 40](#) . Removal, installation and adjusting of toothed belt.
- Remove camshaft ⇒ [page 57](#) .
- Remove rockers, along with supporting elements and place them on a clean surface.
- Ensure rockers with rollers and supporting elements are not mixed.
- Loosen spark plugs.
- Set piston of respective cylinder to "lower neutral position".



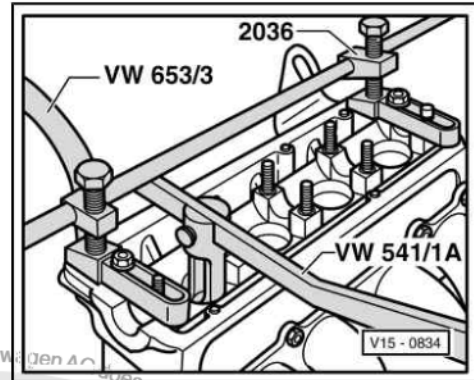


- Fasten assembly device -2036- to head with head cover used bolts.
- Tighten flex pipe -VW 653/3- to spark plug thread.
- Connect pressure hose with compressed air at least 6 bar.
- Remove valve springs with assembly lever -VW 541/1A- and thrust piece -VW 541/5- .



Note

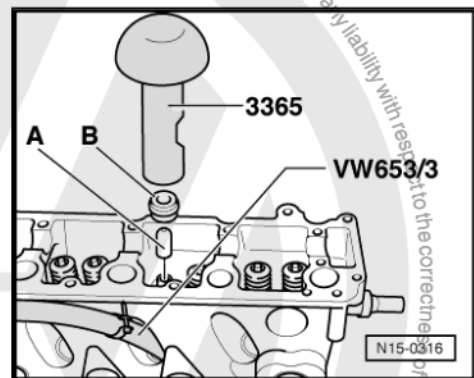
Woodruff keys stuck may be moved if lever is slightly hammered.



- Remove valve seal with impact puller -3364-.

## 2.6.2 Installing

- Place the plastic sleeve -A- supplied on the appropriate valve guide. That prevents damages to the new valve seal -B-.
- Place new valve seal on the compressor with seal fitter -3365- .
- Apply oil to seal lip and carefully slide on valve guide.





## 17 – Lubrication

### 1 Removing and installing parts of the lubrication system



#### Note

Oil level must not be over the Max marking - risk of damages to the catalyst! Marks ➔ [page 65](#)

Check oil pressure ➔ [page 70](#)

Oil supplying quantities

with oil filter 4.0 l. <sup>6)</sup>

6) Current values: ➔ Emissions Test Paste

Engine oil specification

Use oils with high lubricating capacity as per specification VW 502 00 (see Chemicals Manual).

1 - Oil pressure switch -F1-, 25Nm

- ☐ Remove sealing ring in case of leaks and renew it.
- ☐ Check ➔ [page 70](#).

2 - Guide tube

3 - Self-threading screw, 3Nm

- ☐ Screwer maximum rotation: 200 rpm.
- ☐ Fastened to intake collector.

4 - Oil supply cover

- ☐ Renew damaged seal.

5 - Guide tube funnel

- ☐ Pull off to extract oil.

6 - Oil level measuring stick

- ☐ The oil level must not exceed the max. mark!
- ☐ Markings ➔ [page 65](#)

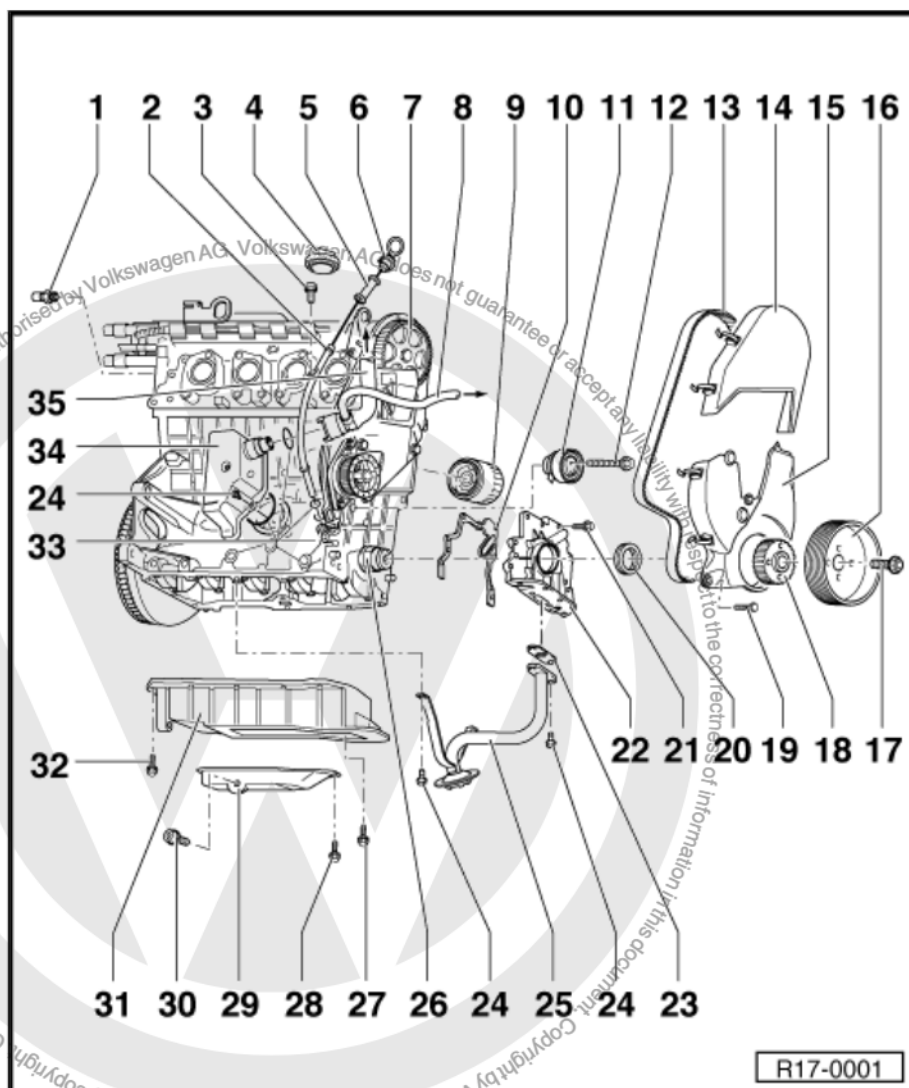
7 - Camshaft sprocket

- ☐ Observe installation position when installing toothed belt ➔ [page 40](#).

8 - For intake collector

9 - Oil filter

- ☐ Loosen through six-sided.
- ☐ Tighten manually.
- ☐ Follow oil filter installation instructions.



R17-0001



## 10 - Gasket

- ☐ Renew.
- ☐ Must seat on adjust guides.

## 11 - Tensioner

- ☐ Check ⇒ [page 38](#)
- ☐ Toothed belt - remove and install, adjust ⇒ [page 40](#) .

## 12 - 20Nm

## 13 - Toothed belt

- ☐ Mark rotation direction before removal.
- ☐ Check wear.
- ☐ Do not kink.
- ☐ Remove and install, adjust ⇒ [page 40](#) .

## 14 - Mechanical distribution upper guard

## 15 - Mechanical distribution lower guard

## 16 - Crankshaft pulley

- ☐ Ensure proper fastening when installing.
- ☐ Remove and install ⇒ [page 40](#) , Removing, installing and tensioning toothed belt removing, installing and adjusting.
- ☐ Remove and install Poly-V belt ⇒ [page 16](#) .

## 17 - Tighten with 90Nm + 90°

- ☐ Renew.
- ☐ To loosen and tighten, use wrench -3415- .
- ☐ Tightening continuation may be done in many phases.
- ☐ Tightening continuation angle may be measured with a regular angle measuring disc, like a Hazet 6690.

## 18 - Crankshaft sprocket

- ☐ Observe installation position when installing toothed belt ⇒ [page 40](#) .

## 19 - 10Nm

## 20 - Seal

- ☐ Renew ⇒ [page 21](#) .

## 21 - 10Nm

## 22 - Front flange/oil pump

- ☐ Replace only complete set.
- ☐ Must seat on adjust guides.
- ☐ To remove and install remove-oil sump.
- ☐ Observe sliding element on crank shaft during installation ⇒ [Item 26 \(page 64\)](#) .
- ☐ Removing and installing oil pump ⇒ [page 68](#) .

## 23 - Gasket

- ☐ Renew.

## 24 - 10Nm

## 25 - Oil sucking pipe

- ☐ Clean sieve, when dirty.

## 26 - Crankshaft journal

- ☐ Lubricate with oil before installing oil pump.

## 27 - Tighten with 10Nm + 90°

- ☐ Renew.
- ☐ Loosen oil sump/engine block securing bolts on pulley side (4 units) inside oil sump.



28 - 15Nm

29 - Sump cover

- ☐ Clean sealing surface before installation.
- ☐ Install with silicone seal "D 176 404 A2".
- ☐ Removing and installing ⇒ [page 65](#) .

30 - Oil draining plug, 30Nm

- ☐ With integrated sealing ring.
- ☐ Renew.

31 - Sump

- ☐ Two pieces.
- ☐ Clean sealing surface before installation.
- ☐ Install with silicone seal "D 176 404 A2".
- ☐ To remove and install, remove oil sump cover.
- ☐ Removing and installing ⇒ [page 65](#) .

32 - Tighten with 10Nm + 90°

- ☐ Renew.

33 - Washer

- ☐ Renew.

34 - Sump ventilation device

35 - To air filter

Markings on oil stick

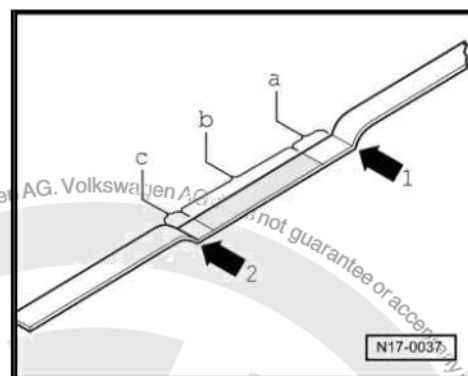
1 - Max.-marking

2 - Min.-marking

a - Area on marked field until max. marking: Do not surpass this marking with more engine oil!

b - Oil level within marked field: May be filled with oil

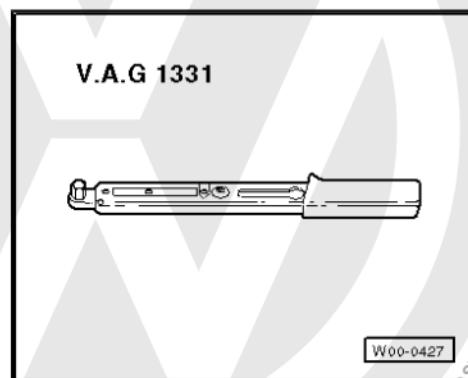
c - Area of minimum marking until marked field: Refill at most 0.5 l of engine oil!



## 1.1 Removing and installing oil sump

Special tools and workshop equipment required

- ◆ Torque wrench (5...50Nm) -V.A.G 1331-



- ◆ Manual drill with plastic brush
- ◆ Flat scraper



- ◆ Silicone seal "D 176 404 A2"
- ◆ Protection goggles

#### Work sequence

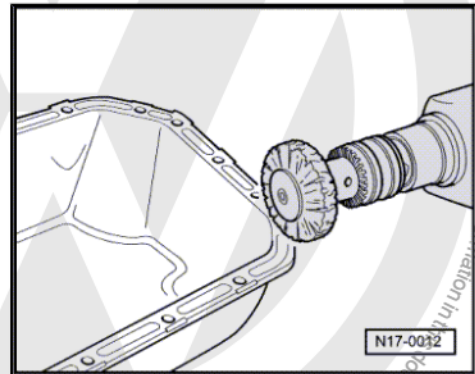
- Remove lower engine compartment anti-noise.
- Disconnect exhaust pipe from exhaust collector  
⇒ [page 130](#) , exhaust collector, front exhaust pipe with catalyst and assembly parts.
- Drain engine oil.



#### Note

*Respect oil disposal regulations!*

- Remove sump cover.
- Remove four sump internal securing bolts, on pulley side.
- Remove two bolts that link clutch body to oil sump mounting.
- Loosen remaining oil sump securing bolts.
- Remove sump. If necessary, loosen sump hammering slightly with rubber hammer.
- Eliminate seal residues that remain on engine block with a flat scraper.
- Eliminate seal residues from oil carter and oil carter cover with a rotary brush, like a plastic brush attached to a manual drill (wear goggles).
- Clean the sealing surfaces. They must be free of oil and grease.



### 1.1.1 Installing



#### Note

- ◆ *Observe seal expiration date.*
- ◆ *Oil sump and cover must be installed within 5 minutes after silicone seal application.*
- ◆ *Oil sump may be easily and safely installed using threaded bolts M6 on two flange points on the engine block.*

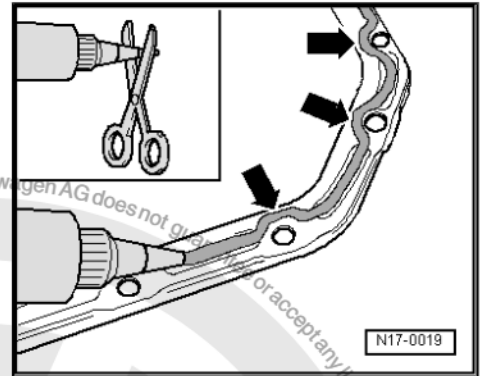


- Cut tube injector on front marking ( $\varnothing$  of injector, which is approx. 3mm).
- Apply silicone seal as shown on sump clean sealing surface. Sealing cord must:
  - ◆ be 2...3mm thick.
  - ◆ Pass on the inside, in the area of bolt holes -arrows-.

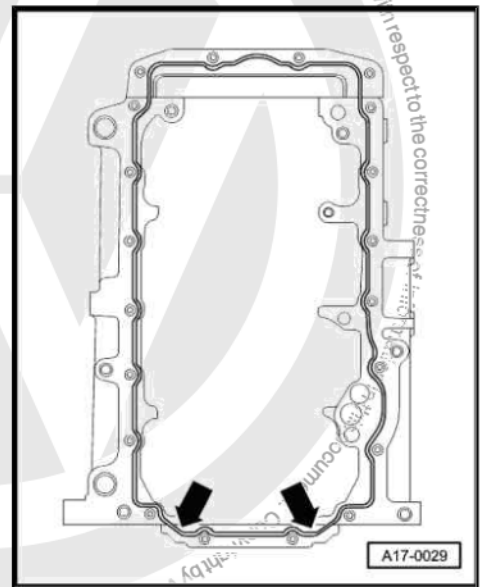


Note

*Sealing cord may not be thicker, otherwise excess seal may drop onto oil sump and clog sieve on oil sucking tube.*



- Apply silicone seal as shown onto sump clean surface (figure shows sealing cord position on engine block).
- Install oil sump immediately and tighten a little all the bolts.
- Tighten new sump bolts at 10Nm.
- Then tighten all bolts more 90°.
- Tighten the sump/gearbox bolts with 40Nm.



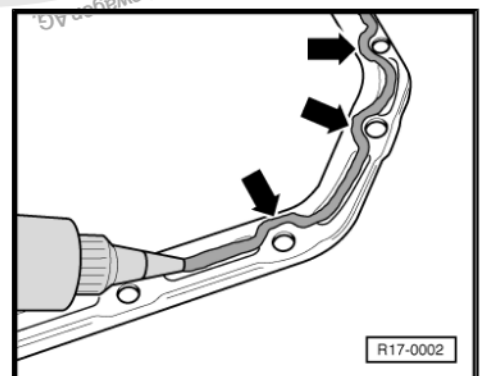
- Apply silicone seal, as shown, onto oil carter cover clean sealing surface. Sealing cord must:
  - ◆ be 2...3mm thick.
  - ◆ Pass on the inside, in the area of bolt holes -arrows-.



Note

*Sealing cord may not be thicker, otherwise excess seal may drop onto oil sump and clog sieve on oil sucking tube.*

- Install oil sump immediately and tighten a little all the bolts.
- Then tighten bolts at 15Nm.



Note

*After oil sump installation, seal must dry for approximately. 30 minutes. Only after that engine oil may be filled.*

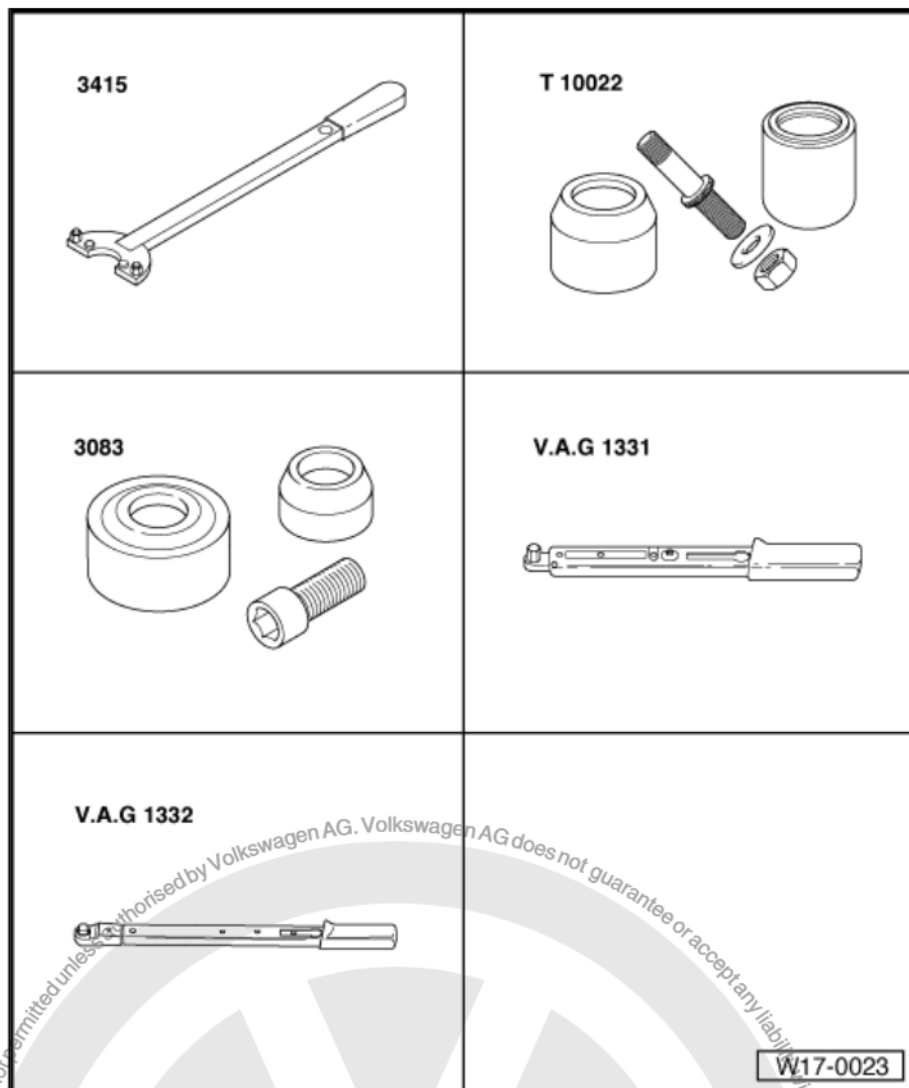




## 1.2 Removing and installing oil pump

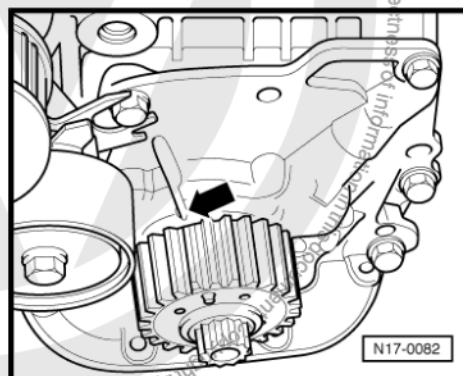
Special tools and workshop equipment required

- ◆ Key -3415-
- ◆ Installation sleeve - T10022-
- ◆ Installing device. -3083-
- ◆ Torque wrench (5...50Nm) - V.A.G 1331-
- ◆ Torque wrench (40...200Nm) -V.A.G 1332-



### 1.2.1 Removing

- Remove toothed belt ➔ [page 40](#) . Remove, install and adjust toothed belt.
- Place crankshaft in cylinder 1 upper neutral position -arrow-. Crankshaft sprocket chamfered tooth must meet mark (2V) on oil pump.





- Turn crankshaft or sprocket to upper neutral position three teeth in counter-clockwise direction: On right side of flat tooth -A- of sprocket, third teeth -arrow- must align with upper neutral position (2V) on oil pump body.



#### Note

*This adjust places crankshaft in position for oil pump installation. One of the four dragging polygonal cams on crankshaft will be on top.*

- Remove crankshaft sprocket. To do this counterhold sprocket with -3415- .
- Remove toothed belt tensor.
- Remove sump ⇒ [page 65](#) .
- Remove oil sucking pipe ⇒ [Item 25 \(page 64\)](#) .
- Remove oil pump.
- Remove sealing gasket.
- Remove seal residues on engine block with a flat scraper.
- Clean sealing surfaces, which must be free from oil and grease.

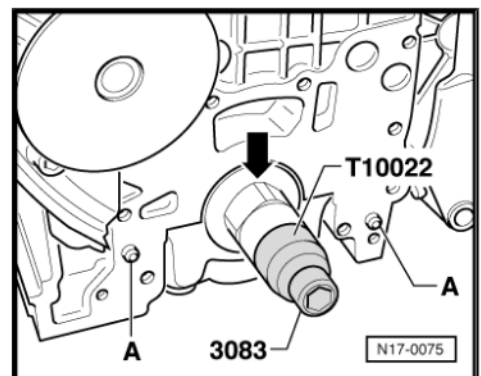
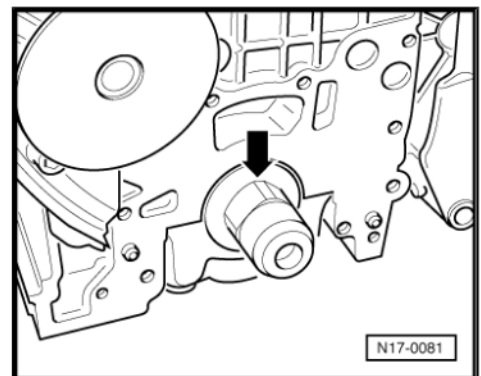
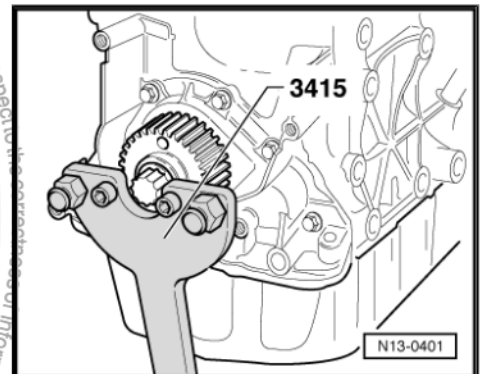
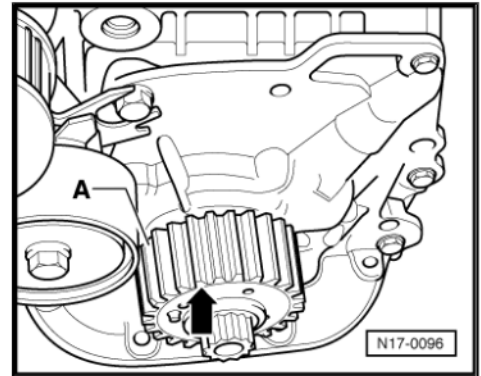
## 2.2 Installing

### Prerequisites

- One of the four dragging polygonal cams on crankshaft will be on top.

### Work sequence

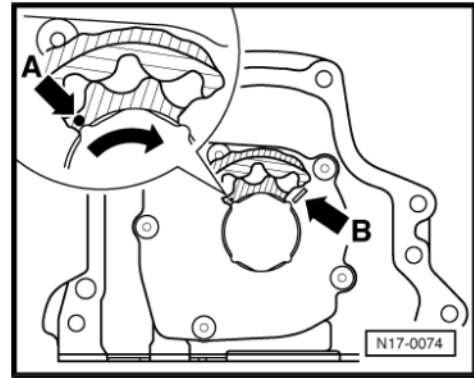
- Place Allen bolt of installing device -3083- with sleeve -T10022- on crankshaft and tighten manually.
- Place new sealing joints on guides -A-.



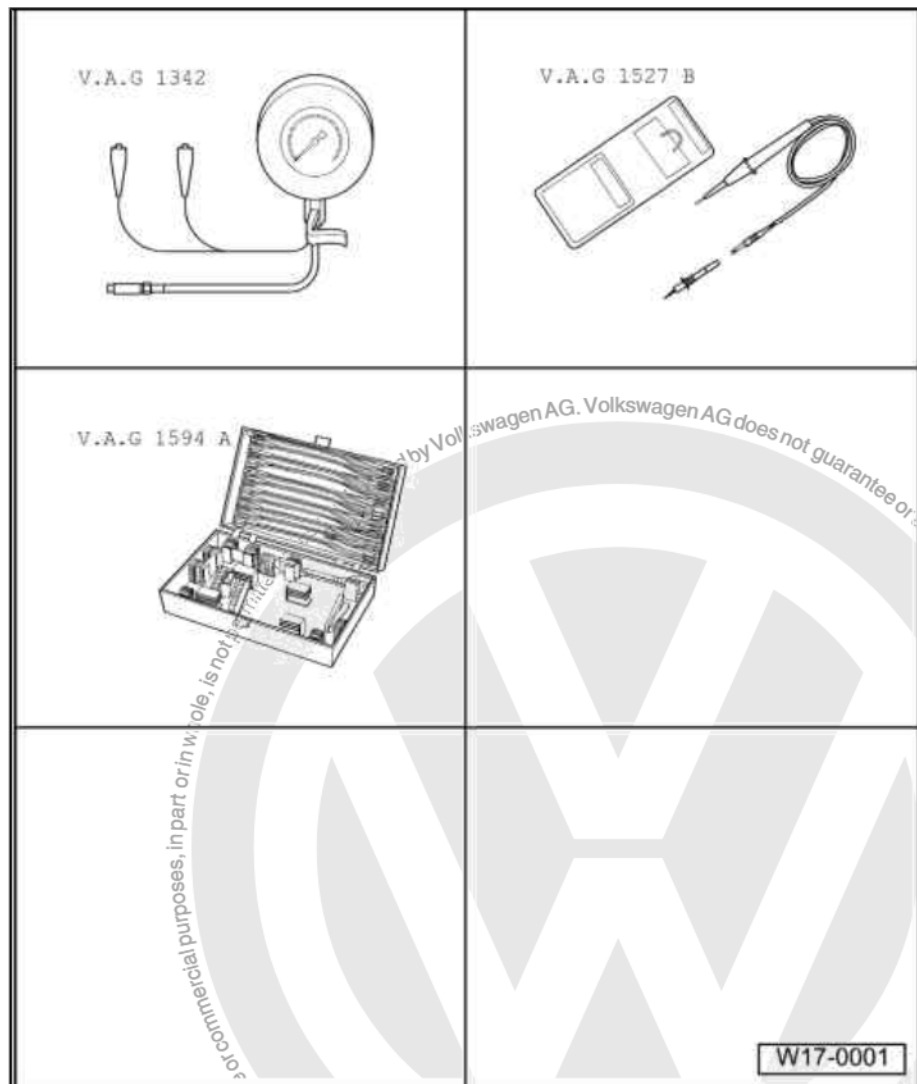


- Place marking -arrow A- of oil pump internal rotor on installation position-marking -arrow B- of oil pump body cover.
- Apply oil to the four dragging polygonal cams on crankshaft.
- Carefully place oil pump onto the four dragging polygonal cams of crankshaft.
- Align internal rotor turning it a little on the four dragging polygonal cams of crankshaft.
- Next, carefully place oil pump onto the guides.
- Screw oil pump. Tightening torque: 10Nm.
- Remove installation sleeve -T10022- .
- Install oil sucking pipe ⇒ [Item 25 \(page 64\)](#) .
- Install sump ⇒ [page 65](#) .

How to install toothed belt and adjust control times ⇒ [page 40](#) .



### 1.3 Checking oil pressure and oil pressure switch



#### Special tools and workshop equipment required

- ◆ Oil pressure testing device -V.A.G 1342-



- ◆ Test LED -V.A.G 1527 B-
- ◆ Measuring adapter set -V.A.G 1594 A-

#### Test conditions

- Check if engine oil level is OK
- Engine oil temperature at least 80°C (coolant fan must have started at least once)



#### Note

*Operation and repair test of oil pressure visual and acoustic indicator: ➔ Electric diagrams, Fault location in the electric system and installation positions*

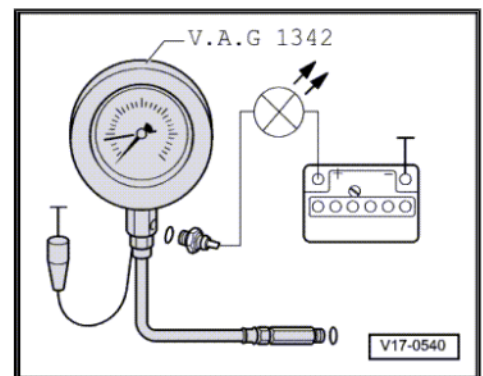
#### Test sequence

- Remove oil pressure switch -F1- and fasten it with bolts to test equipment.
- Install test equipment on the place of oil pressure switch on engine head.
- Connect brown cable of ground test equipment (-).
- Connect diode test lamp -V.A.G 1527 B- with auxiliary cables of -V.A.G 1594 A- to battery positive (+) and oil pressure switch. Test LED shall not light up.
- If the LED lights up, renew oil pressure switch -F1-.

If the LED does not light up:

- Keep engine running and slowly increase rotation. at 0.3...0.6 bar pressure LED must turn on, otherwise replace oil pressure switch.
- Continue rising rotation. At 2000 rpm and oil temperature of 80°C, oil pressure must be at least 2.0 bar.

At higher rotations, oil pressure cannot surpass 7.0 bar.





## 19 – Cooling system

### 1 Removing and installing parts of cooling system



#### WARNING

*For removal jobs, especially in the engine compartment, due to reduced existing space, consider the following:*

- ◆ *All hoses (fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid vacuum) and electric cables must be restored to original positions.*
- ◆ *Ensure easy access to mobile parts that may be hot.*



#### Note

- ◆ *Cooling system is under pressure when engine is hot. Therefore, it is necessary to reduce pressure before repairs.*
- ◆ *Hose connections are fastened by springtype braces. For repairs, use solely springtype braces.*
- ◆ *To assemble spring braces, it is recommended the use of installation equipment -VAS 5024- or pliers -V.A.G 1921- .*
- ◆ *Coolant hoses must be stretched without tension-and in such a way that they do not touch other components (observe marking on coolant junction on the hose).*

Ensure cooling system is not leaking with cooling system checking equipment -V.A.G 1274- and adapters -V.A.G 1274/8- and -V.A.G 1274/9- .

Cooling system components on body side ⇒ [page 73](#) .

Cooling system components on engine side ⇒ [page 74](#) .

Coolant hoses connection diagrams ⇒ [page 76](#) .

Drain and fill coolant ⇒ [page 77](#) .

Indications for mixing coolant ⇒ [page 77](#) , Coolant. draining and filling.





## 1.1 Cooling system components, body side

### 1 - Radiator

- ☐ Removing and installing  
⇒ [page 80](#) .
- ☐ After replacing it,  
change all the cooling  
fluid.

### 2 - Seal

- ☐ Renew.

### 3 - Upper coolant hose

- ☐ Fastened to radiator  
with clamps.
- ☐ Ensure proper fasten-  
ing.
- ☐ Coolant hose connec-  
tions diagram  
⇒ [page 76](#) .

### 4 - Engine temperature sensor --G62--

- ☐ With sensor for coolant  
temperature indicator -  
G2- .
- ☐ For engine control unit.
- ☐ When removing, first re-  
lease system pressure.

### 5 - Lock

### 6 - Wind deflector

### 7 - 10Nm

### 8 - Auxiliary fan

- ☐ In vehicles with air con-  
ditioning.

### 9 - Retaining clip

- ☐ Ensure proper fastening.

### 10 - Bracket

- ☐ For electric fan.

### 11 - Connector

### 12 - Fan -V7-

### 13 - For coolant thermostatic valve body

- ☐ Coolant hoses connection diagram ⇒ [page 76](#) .

### 14 - Coolant tank

- ☐ Ensure cooling system is not leaking with cooling system checking equipment -V.A.G 1274- and adapter -V.A.G 1274/8- .

### 15 - Cover

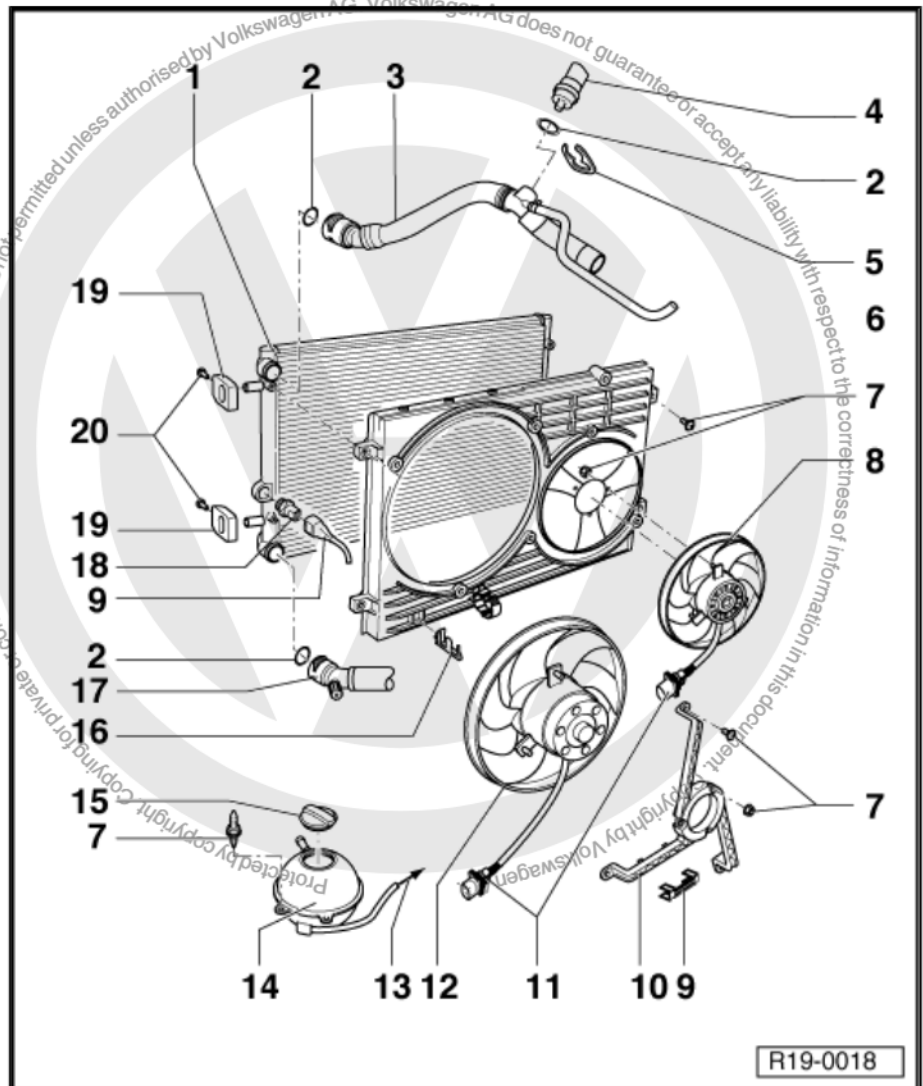
- ☐ Check with cooling system test equipment -V.A.G 1274- and adapter -V.A.G 1274/9- .
- ☐ Test pressure 1.4...1.6 bar.

### 16 - Bracket

- ☐ For radiator fan connector.

### 17 - Lower coolant hose

- ☐ Fastened to radiator with retaining clips.







- ☐ Ensure proper fastening.
- ☐ Coolant hoses connection diagram ⇒ [page 76](#) .

## 18 - Thermal switch -F18- , 35Nm

- ☐ For electric fan.
- ☐ Not applicable.

## 19 - Bracket

- ☐ To radiator.
- ☐ Observe installation position.
- ☐ Observe the different models.

20 - 10Nm

## 1.2 Cooling system components on engine side

## 1 - Connection

## 2 - Self-locking bolt, 9Nm

## 3 - O-ring

- ☐ Renew.

## 4 - Thermostatic valve

- ☐ Checking function: Heat valve with water. Thermal element pin must move outward.
- ☐ Temperature test: Opening start (approx. 84°C) and opening closure (approx. 98°C) cannot be performed.

## 5 - For heat exchanger

- ☐ Coolant hoses connection diagram ⇒ [page 76](#) .

## 6 - Coolant tank

- ☐ Coolant hoses connection diagram ⇒ [page 76](#) .

## 7 - Thermostatic valve body

## 8 - Of the heat exchanger

- ☐ Coolant hoses connection diagram ⇒ [page 76](#) .

## 9 - Coolant pipe

- ☐ Coolant hoses connection diagram ⇒ [page 76](#) .

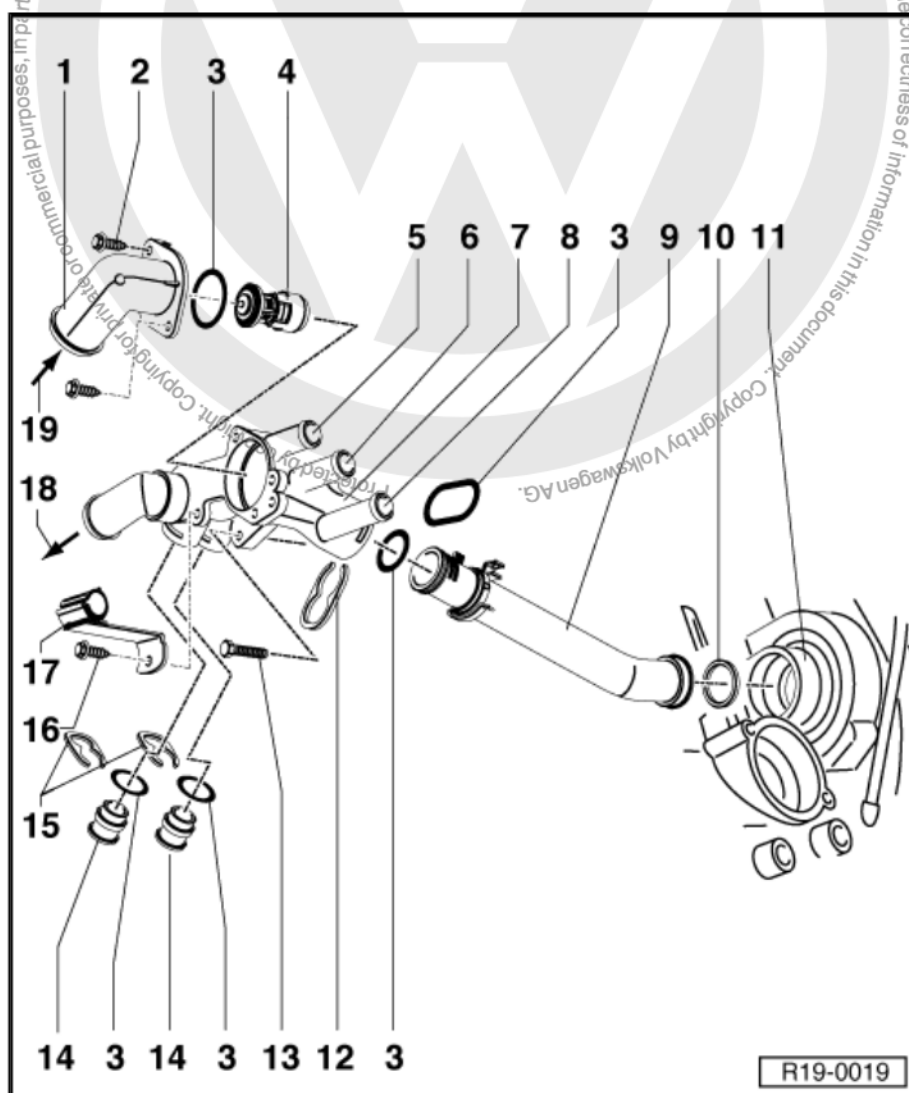
## 10 - O-ring

- ☐ Renew.

## 11 - Water pump body on engine block

## 12 - Retaining clip

- ☐ Ensure proper fastening.

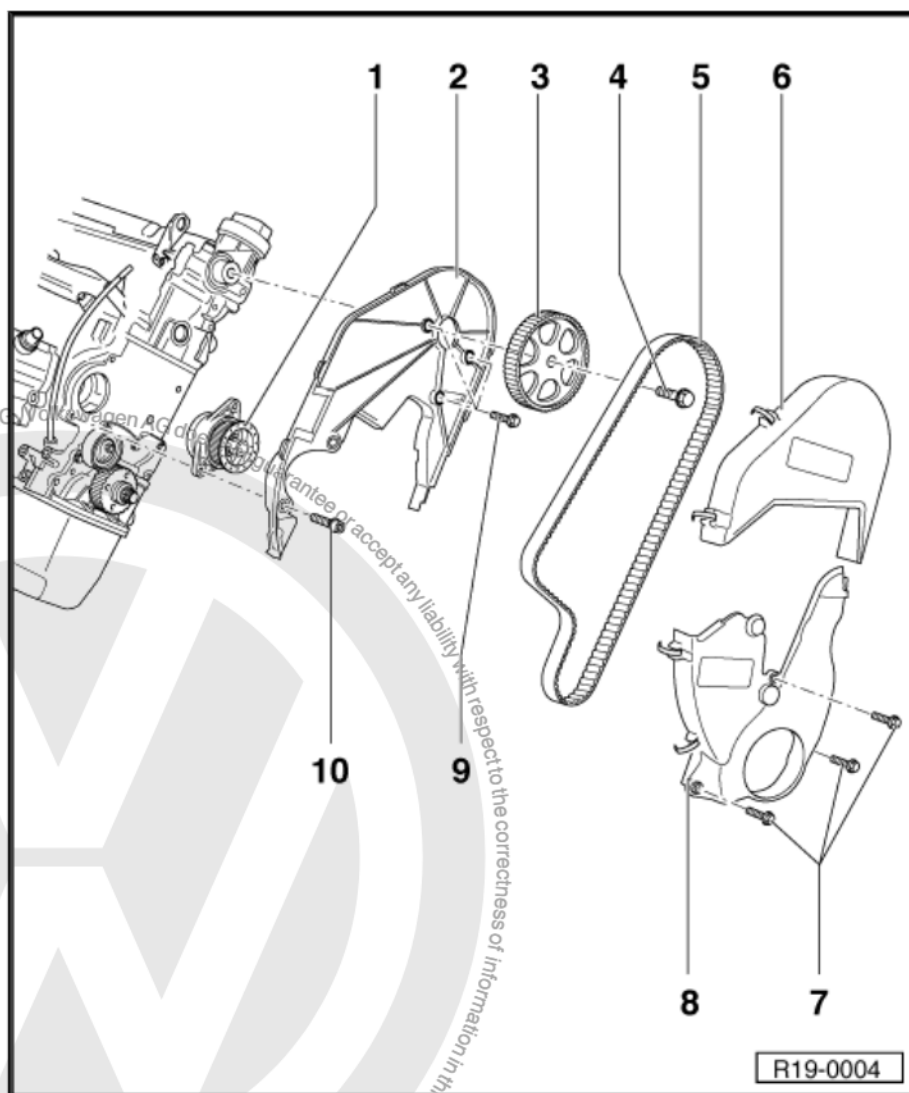




- 13 - 10Nm
- 14 - Sealing plug
  - ☐ If necessary, depressurise system before removal.
- 15 - Retaining clip
  - ☐ Ensure proper fastening.
- 16 - Self-locking bolt, 6Nm
- 17 - Bracket
- 18 - For radiator, below
  - ☐ Coolant hoses connection diagram ⇒ [page 76](#) .
- 19 - For radiator, on top
  - ☐ Coolant hoses connection diagram ⇒ [page 76](#) .

### 1.2.1 Water pump side

- 1 - Water pump
  - ☐ With integral sealing gasket.
  - ☐ Sealing joint must not be separated from pump.
  - ☐ In case of faults and leakage, renew complete pump and seal.
  - ☐ Check smooth operation.
  - ☐ Remove e instalat  
⇒ [page 82](#) .
- 2 - Mechanical distribution rear guard
- 3 - Camshaft sprocket
  - ☐ Ensure proper fastening when installing.
  - ☐ Ensure correct toothed belt installation position  
⇒ [page 40](#) .
- 4 - Tighten with 20Nm + 90°
  - ☐ Renew.
  - ☐ To loosen and tighten, hold camshaft sprocket with counter-support -3036- .
- 5 - Toothed belt
  - ☐ Mark rotation direction before removal.
  - ☐ Check wear.
  - ☐ Do not kink.
  - ☐ Removing, installing and adjusting  
⇒ [page 40](#) .





6 - Mechanical distribution upper guard

7 - 10Nm

8 - Mechanical distribution lower guard

9 - 10Nm

□ Apply with D/00600/A2/.

10 - 20Nm

### 1.3 Coolant hoses connections diagram

1 - Coolant tank

2 - Heat exchanger

3 - Lower coolant hose

4 - Radiator

5 - Upper coolant hose

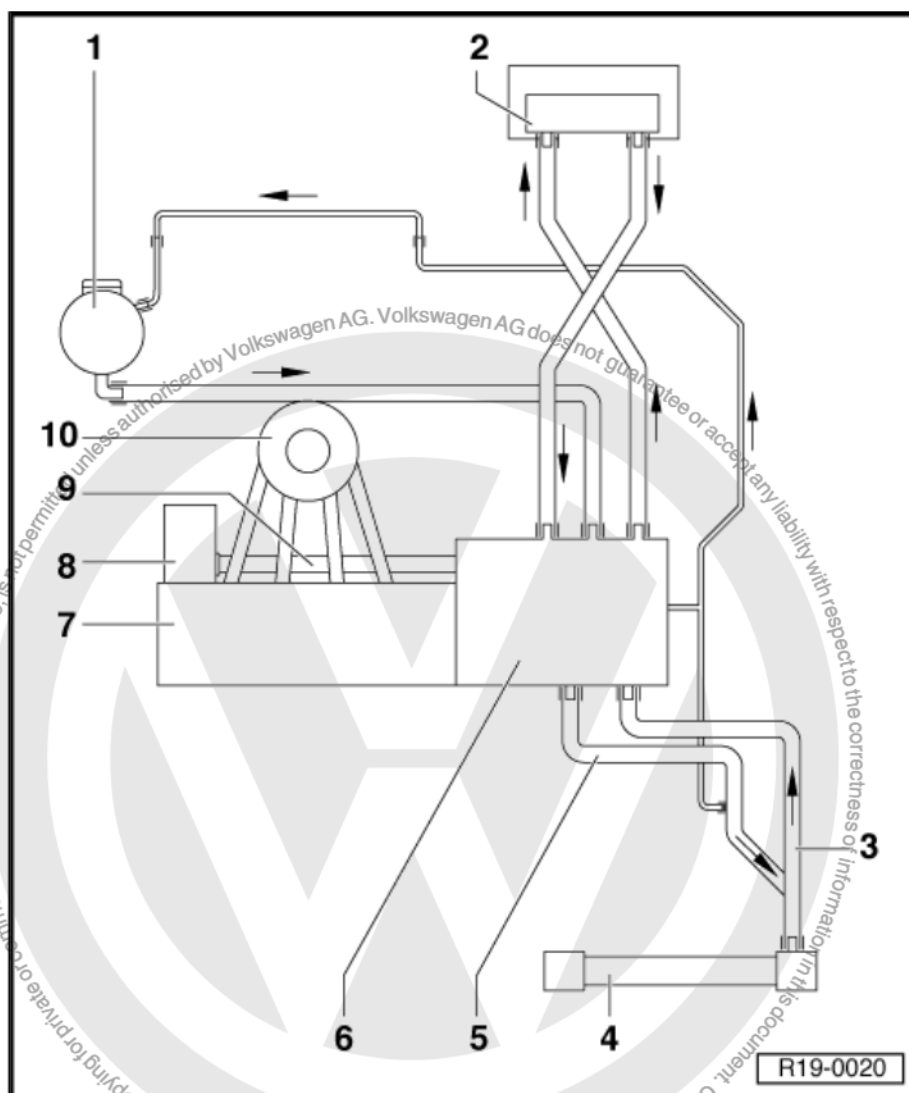
6 - Thermostatic valve body

7 - Engine block/engine head

8 - Water pump

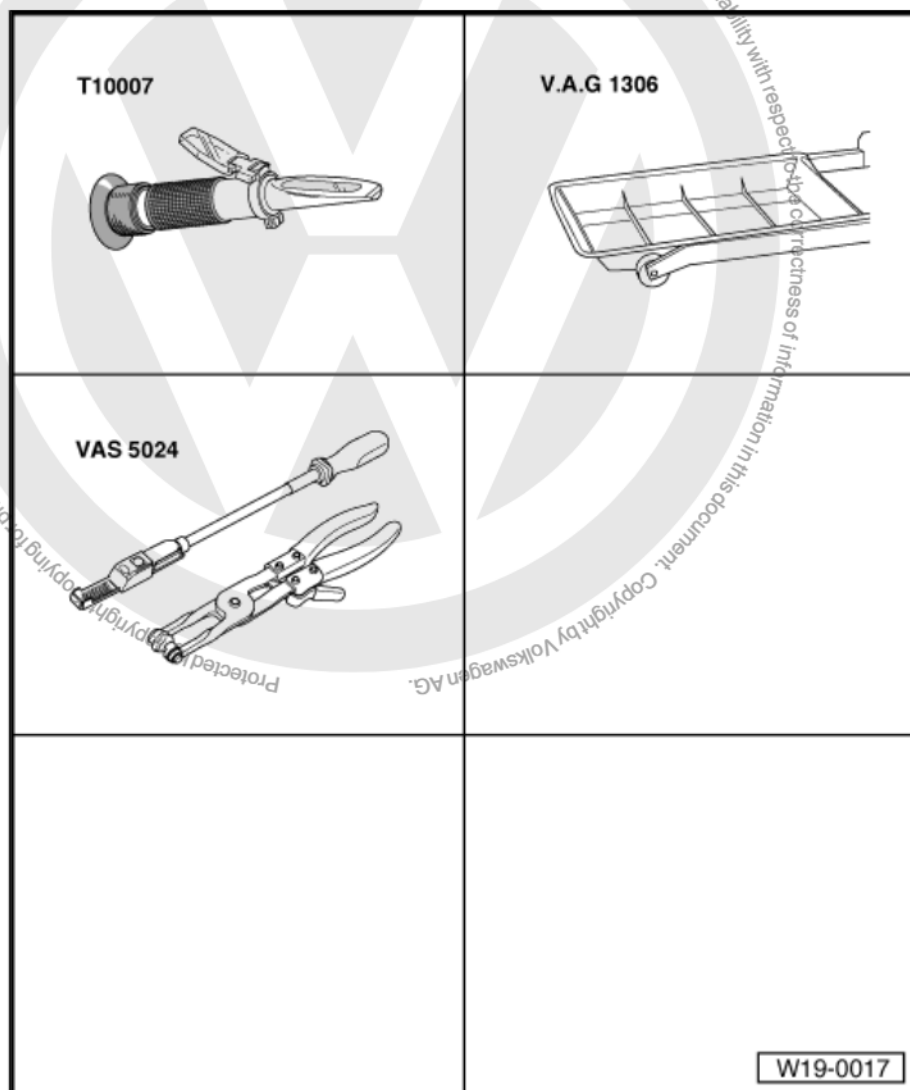
9 - Coolant pipe

10 - Suction line





## 1.4 Draining and filling coolant



### Special tools and workshop equipment required

- ◆ Refraction meter -T10007-
- ◆ Oil collector -V.A.G 1306-
- ◆ Assembly tool for springtype clips -VAS 5024-

No figure

- ◆ Cooling system supplying equipment -VAS 6096-

### 1.4.1 Draining



#### WARNING

*Steam can be released when removing the cover from the expansion tank, place a piece of cloth around cover and open carefully.*

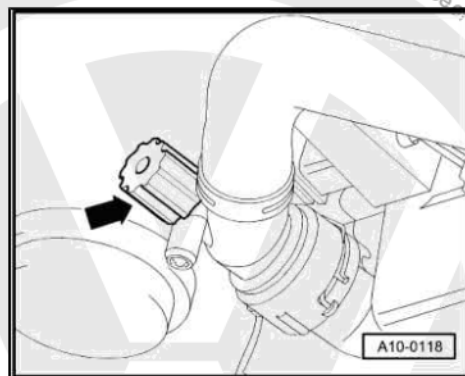
- Open cap on coolant expansion tank.
- Remove lower engine compartment anti-noise.



- To drain coolant from radiator remove drain plug -arrow-.

**Note**

*Follow coolant disposal recommendations!*

**1.4.2 Fill****Note**

- ◆ *Anti-freezing G12 may only be used in accordance with standard TL VW 774 D. It is identified by the red colour.*
- ◆ *Never mix G12 with other anti-freezing additives.*
- ◆ *If coolant in tank is brown the G12 has been mixed to other anti-freezing additive and it is necessary to fully renew coolant.*
- ◆ *G12 and anti-freezing additives with "in accordance with TL VW 774 D" indication prevent damages due to corrosion, freezing or mould formation, increasing even more coolant boiling temperature. For these reasons, cooling system must always have the prescribed mix of anti-freezing and anti-corrosion products.*
- ◆ *Especially in tropical countries, anti-freezing helps, due to the high boiling temperature it provides, to ensure operation safety when engine is submitted to heavy duty operation.*
- ◆ *Anti-freezing protection must be ensured until nearly -25°C (in cold countries, until nearly -35°C).*
- ◆ *Coolant concentration must not be reduced adding water during hot seasons in hot countries. Anti-freezing proportion must be, at least, 40%.*
- ◆ *If the climate makes necessary more anti-freezing protection, G12 percentage may be increased, but only until 60% (anti-freezing protection up to -40°C). The higher protection lowers cooling capacity and anti-freezing protection.*
- ◆ *To determine anti-freezing protection density, it is recommendable to use refraction meter -T10007-.*
- ◆ *If radiator, heat exchanger, cylinder head or cylinder head gasket is renewed, do not reuse old coolant.*

Recommended mixture ratios:

Anti-freezing protection until	Anti-freezing proportion	G 12 <sup>7)</sup>	Water <sup>7)</sup>
-25°C	40%	2.25l	3.35l
-35°C	50%	2.8l	2.8l

7) Quantity of coolant may vary depending on each vehicle equipment.

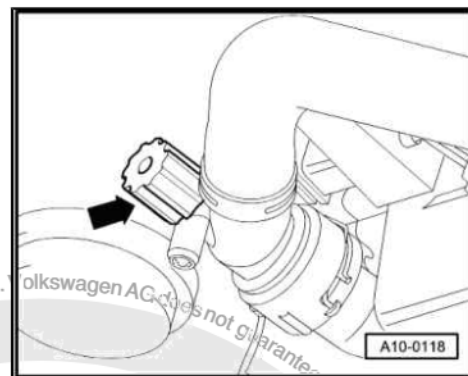


- Close coolant -arrow- draining plug.
- Install lower engine compartment anti-noise.

With coolant supplying equipment -VAS 6096-

- Supply cooling circuit with coolant using cooling system supplying equipment -VAS 6096- : ➔ See instruction manual for coolant system supplying equipment VAS 6096

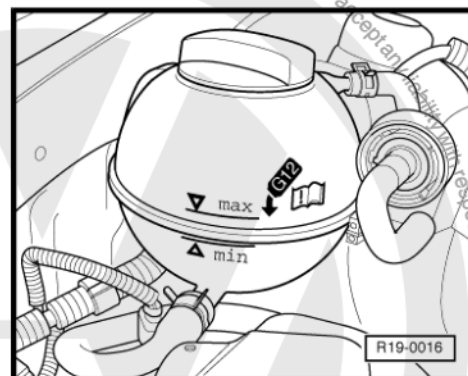
Without coolant supplying equipment -VAS 6096-



- Refill coolant until upper mark of graded field of coolant tank.

With and without coolant system supplying equipment - VAS 6096-

- Close compensation container.
- Turn off heating start.
- Start engine and keep 2000/min rotation for approximately 3 minutes.
- Leave engine running until fan turns on.



#### WARNING

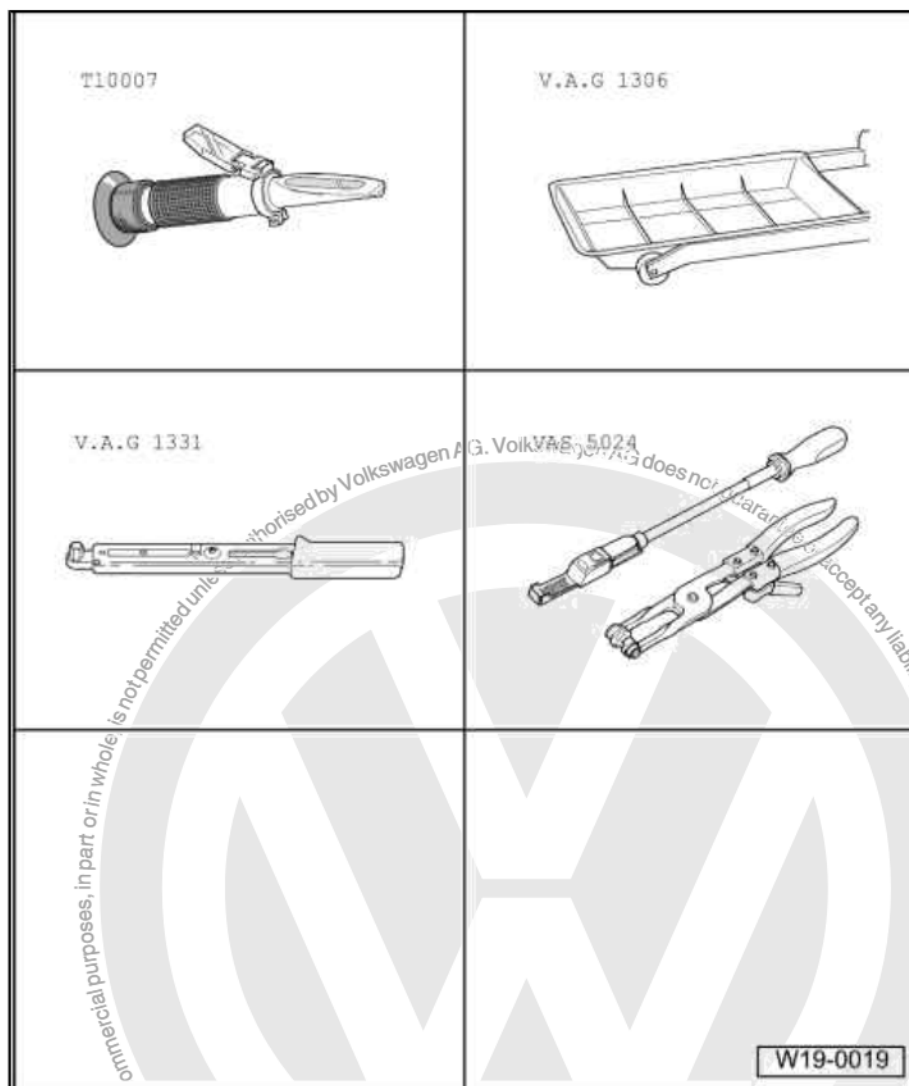
*Steam can be released when removing the cover from the expansion tank, place a piece of cloth around cover and open carefully.*

- Check coolant level and top up if necessary. With engine hot, cooling fluid must be on max. marking, with engine cool it must be between max. and min. markings.





## 1.5 Removing and installing the radiator



### Special tools and workshop equipment required

- ◆ Refraction meter -T10007-
- ◆ Oil collector -V.A.G 1306-
- ◆ Torque wrench (5...50Nm) -V.A.G 1331-
- ◆ Assembly tool for springtype clips -VAS 5024-

### 1.5.1 Removing

- Remove the bumper cover. ⇒ Rep. Gr. 63 ; Removing and installing bumper cover
- Removing front panel ⇒ Rep. Gr. 50 ; Removing and installing front body with complements
- Drain coolant ⇒ [page 77](#) .
- Disconnect quick couplings of radiator coolant hoses.
- Remove radiator fan connector.
- Remove radiator securing bolts and remove radiator with fan.



Vehicles with air conditioning:

- Note additional indications and installation jobs ⇒ [page 81](#) .

## 1.5.2 Installing

Installation happens in removal reversed order, considering the following:

- Fill coolant ⇒ [page 77](#)
- Intall front panel ⇒ Rep. Gr. 50 ; Removing and installing front body with complements
- Install bumper cover ⇒ Rep. Gr. 63 ; Removing and installing bumper cover

## 1.5.3 Additional indications and installation jobs in vehicles with air conditioning



### WARNING

*Air conditioning cooling gas circuit must not be opened.*



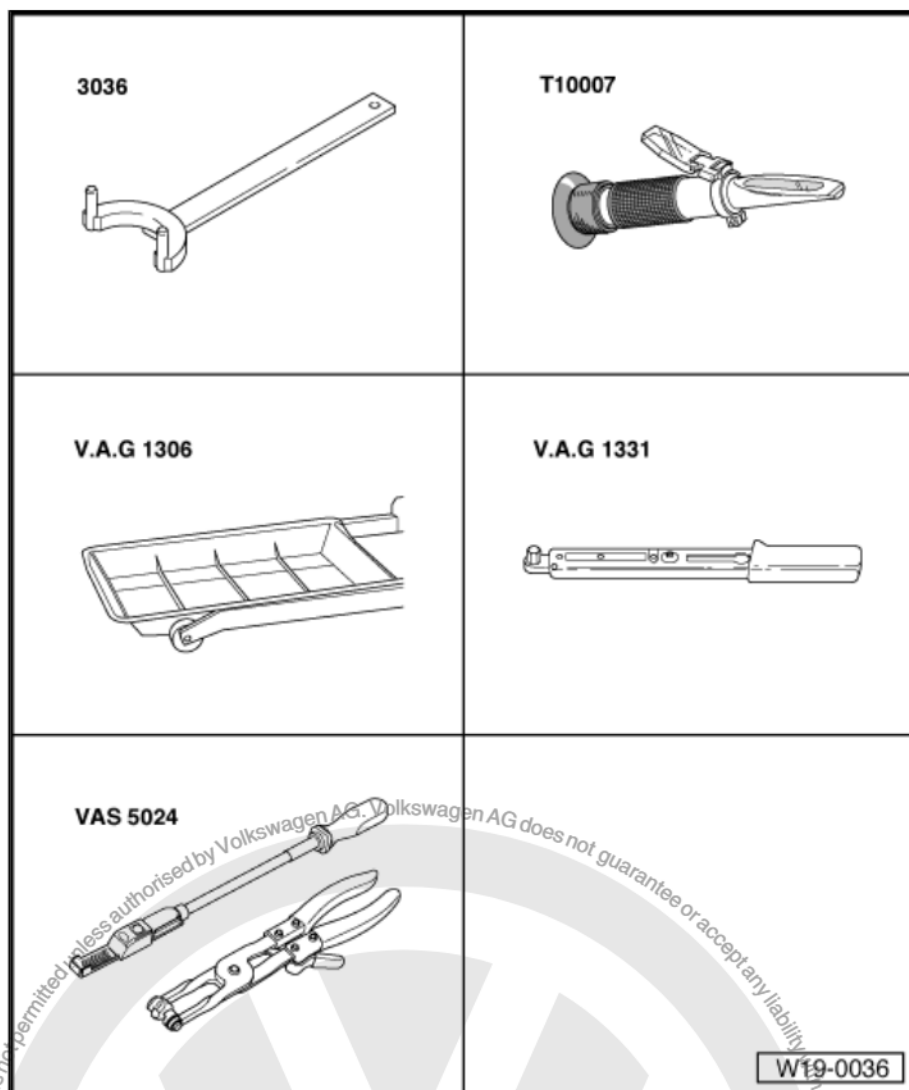
### Note

*To avoid damages to the condenser and refrigerant pipes/hoses, ensure they are not twisted, folded or excessively stretched.*

- Loosen retaining brace(s) of refrigerant hoses.
- Loosen radiator condenser and lean in on a support.



## 1.6 Removing and installing coolant pump



### Special tools and workshop equipment required

- ◆ Counter-support -3036-
- ◆ Refraction meter -T10007-
- ◆ Oil collector -V.A.G 1306-
- ◆ Torque wrench (5...50Nm) -V.A.G 1331-
- ◆ Assembly tool for spring braces -VAS 5024-



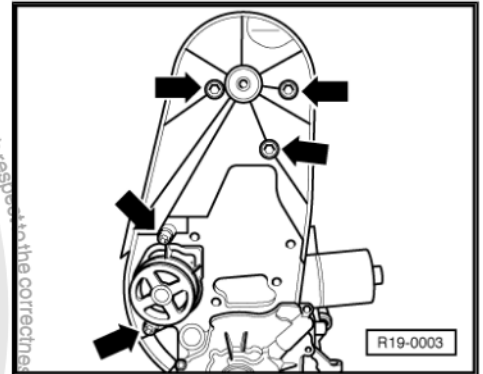
### Note

- ◆ *Water pump integrated seal cannot be separated from pump.*
- ◆ *In case of faults and leakage, renew complete pump and seal.*

### 1.6.1 Removing

- Drain coolant ⇒ [page 77](#) .

- Remove toothed belt ➔ [page 40](#) . Remove, install and adjust toothed belt.
- To loosen bolt, remove and hold camshaft sprocket with counter-holder -3036- .
- Loosen securing bolts -arrows- of manual gearbox rear guard and water pump.
- Remove water pump along with engine block manual gearbox rear guard.



### 1.6.2 Installing

Installation happens in removal reversed order, considering the following:

- Install water pump with manual gearbox rear guard and tighten lower securing bolts. Tightening torque: 20Nm.
- Tighten three upper securing bolts of manual gearbox rear guard. Tightening torque: 10Nm (place with D/ 00 600/A2/).
- Install camshaft sprocket and tighten new bolt (use special tool -3036- ). Tightening torque: 20Nm + 90°.

How to install toothed belt and adjust control times ➔ [page 40](#) .

Fill new coolant ➔ [page 77](#) .



## 20 – Fuel supply system

### 1 Removing and installing fuel supply system components



#### Note

- ♦ *Hose connections are secured by springtype braces and quick couplings (pop top), whose lock must be renewed whenever disconnected.*
- ♦ *To fasten fuel hoses to engine use only springtype braces; clamp or bolted braces are not allowed.*
- ♦ *To assemble springtype braces, it is recommended the use of installation equipment -VAS 5024- or pliers -V.A.G 1921-.*

Respect safety recommendations ⇒ [page 86](#) .

Respect cleaning rules ⇒ [page 87](#) .

Remover e instalar o reservatório de combustível ⇒ [page 94](#) .

Fuel tank components, accessories and filter - removing and installing ⇒ [page 85](#) .

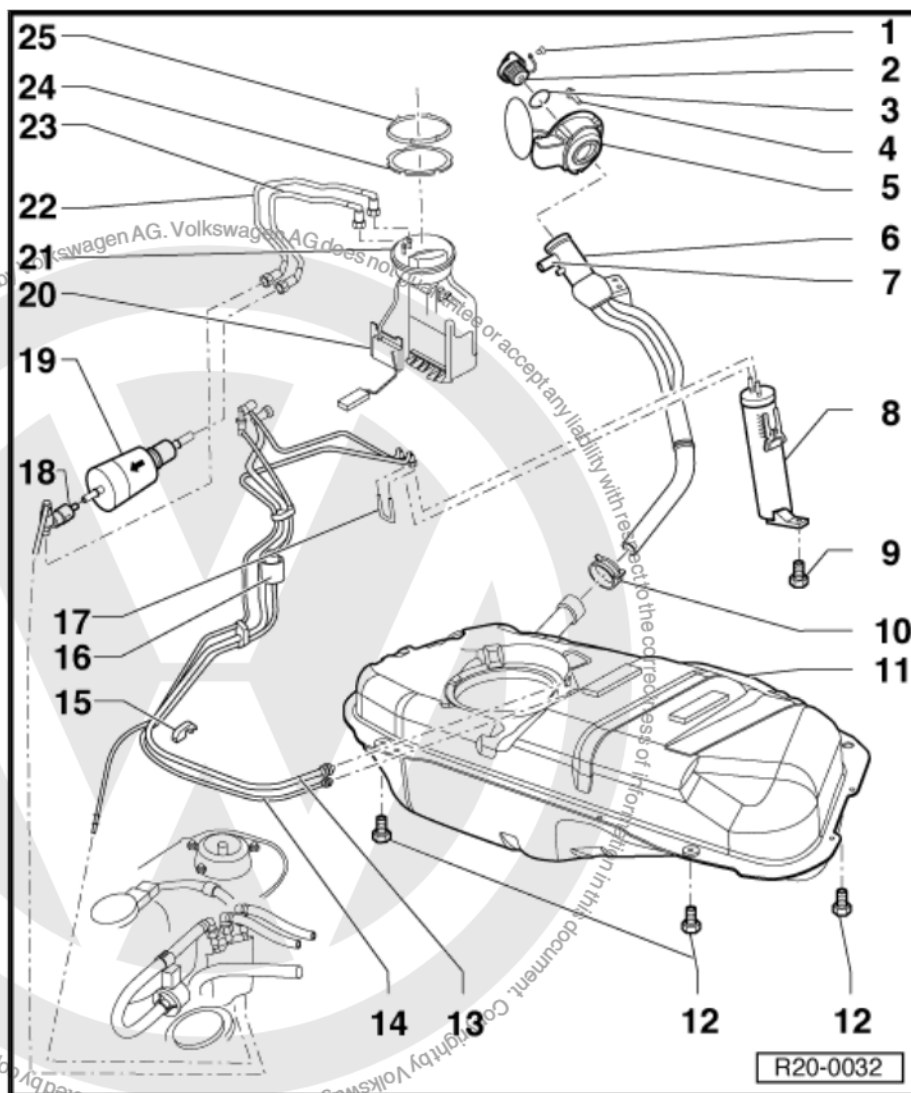
Repair electronic adjusting of engine power (electric throttle) ⇒ [page 103](#) .

Repair activated charcoal filter system components ⇒ [page 106](#) .



## 1.1 Remove and install fuel tank with accessory parts and fuel filter - removing and installing

- 1 - Securing clip
- 2 - Tank cover
- 3 - O-ring
  - ☐ Renew if damaged.
- 4 - Mounting screw
- 5 - Tank flap unit
  - ☐ With rubber cup.
  - ☐ Removing and installing  
⇒ Rep. Gr. 55 : Tank lid; removing and installing tank lid.
- 6 - Fuel filling pipe
- 7 - Vent valve
  - ☐ ⇒ [page 86](#)
- 8 - Activated charcoal filter
  - ☐ Fitting location: on right rear wheel housing.
- 9 - 10Nm
- 10 - Springtype braces
- 11 - Fuel tank
  - ☐ Remove using engine and gearbox lift - V.A.G 1383A- .
  - ☐ Removing and installing  
⇒ [page 94](#)
- 12 -  $26 \pm 3\text{Nm}$
- 13 - Tank hose to activated charcoal filter
- 14 - Tank hose to gravity valve
- 15 - Bearing
- 16 - Gravity valve
  - ☐ To remove, remove right rear wheel housing liner.
  - ☐ Check valve flow continuity. Perpendicular valve: open. Valve tilted  $45^\circ$ : closed.
- 17 - Junction
- 18 - Quick coupling
- 19 - Fuel filter
  - ☐ Installation position: arrow indicates flow direction.
- 20 - Fuel level indicator sensor
  - ☐ Removing and installing ⇒ [page 94](#) .
- 21 - Fuel delivery unit
  - ☐ Removing and installing ⇒ [page 92](#) .
  - ☐ Clean filter if dirty.
  - ☐ Check fuel delivery unit ⇒ [page 97](#) .
  - ☐ Ensure correct installation position on the fuel tank ⇒ [page 86](#)







22 - Brake pipe

- ☐ Black.
- ☐ Ensure proper fastening.
- ☐ Of fuel distributor.

23 - Brake pipe

- ☐ Blue.
- ☐ Fastened to the side of fuel tank.
- ☐ Ensure proper fastening.

24 - Thrust washer

25 - Circlip

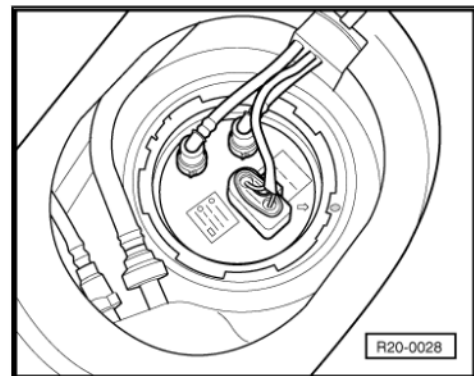
Fitting position of flange of fuel delivery unit

Sensor -arrow- must meet yellow dot on the right side of body.

Return hose blue -1- on connection.

Intake pipes -2- on connection.

Pump electric connector -3-.



Note

*After fuel delivery unit flange installation, check if supply, return and ventilation hoses are still fastened to fuel tank.*

Checking vent valve

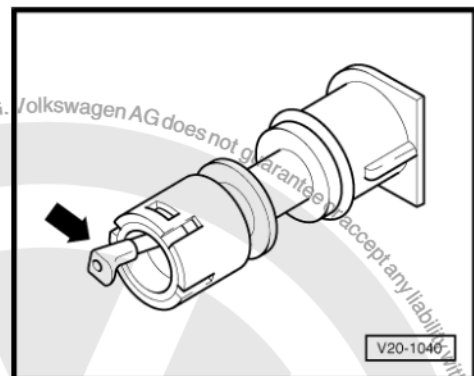
Lever in resting position: closed.

Lever pushed in arrow direction: open.



Note

*Before ventilation valve installation, remove fuel tank lid.*



## 1.2 Safety precautions for jobs on fuel supply system



WARNING

*For removal jobs, especially in the engine compartment, due to reduced existing space, consider the following:*

- ◆ *All hoses (fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid vacuum) and electric cables must be restored to original positions.*
- ◆ *Ensure easy access to mobile parts that may be hot.*

When removing or installing fuel level sensor or fuel delivery unit, with fuel tank full or partially full, observe the following:

**WARNING**

*Fuel supply hose is under pressure! Before loosening hose junctions, place a cloth around them. Next, eliminate pressure removing hose carefully.*

- ◆ Before starting jobs it is necessary to have, near the installation area of fuel tank, the sucking hose of an extracting equipment (exhauster) in operation, to absorb gases released by the fuel. If an exhauster is not available, use a radial fan (engine out of air flow) with air moving rate higher than 15 m<sup>3</sup>/hour.
- ◆ Avoid contact of skin with fuel! Use fuel resistant gloves!
- ◆ For safety reasons, before opening system, remove fuse num. 33 of fuel delivery unit supply

### 1.3 Rules for cleanliness

For jobs on the fuel/ injection system, strictly respect the "5 cleaning rules":

- ◆ Deeply clean connections and surrounding areas before disconnecting them.
- ◆ Place parts on clean surface and cover them. Use only lint free clothes!
- ◆ If repair jobs are not going to be carried out immediately, components removed from packaging must be covered or carefully preserved.
- ◆ Install only clean components. Remove spare parts from packaging shortly before installing them. Do not install components that have been kept out of packaging (i.e. inside the tool box, etc.).
- ◆ With system open: If possible, avoid using compressed air. If possible, do not move vehicle.

### 1.4 Connecting and disconnecting "Pop Top" quick coupling

Special tools and workshop equipment required

- ◆ -VW 049-

#### 1.4.1 Disconnect

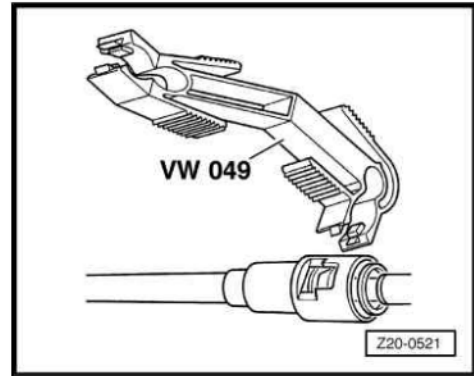
Initial considerations

**Note**

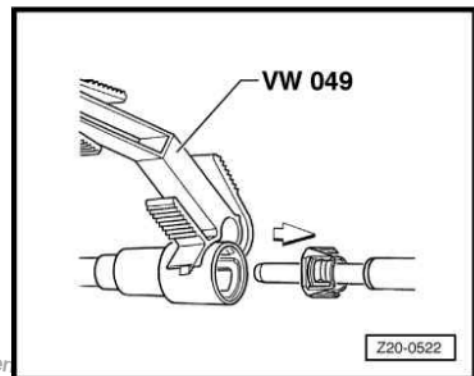
*Fuel in supplying line is kept under pressure, so eliminate pressure before disconnecting hoses.*



- Position tool on connector.



- Pull connection body tube, disconnecting it.

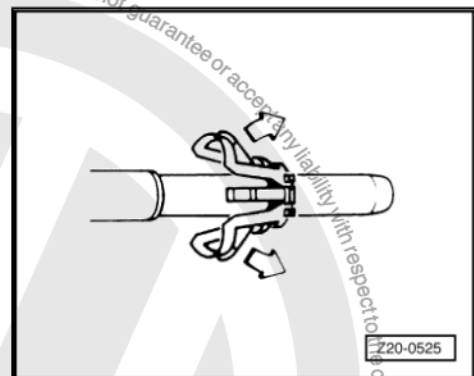


- To remove lock move it in arrows direction.



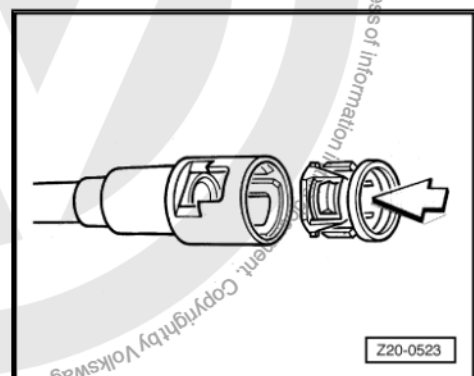
**Note**

*Whenever undoing a quick coupling, lock must always be renewed.*



## 1.4.2 Connect

- Using a new lock, install it on the connector.



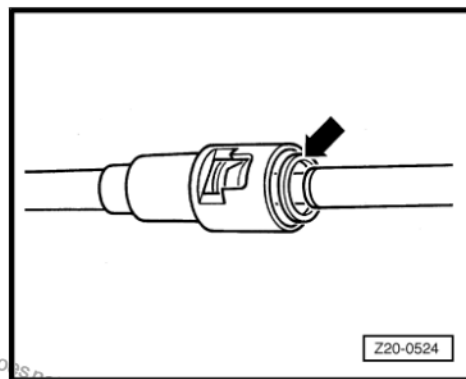


- Redo connection. The ring for correct mounting checking is freed from lock by pulling connector in the direction of disengagement.

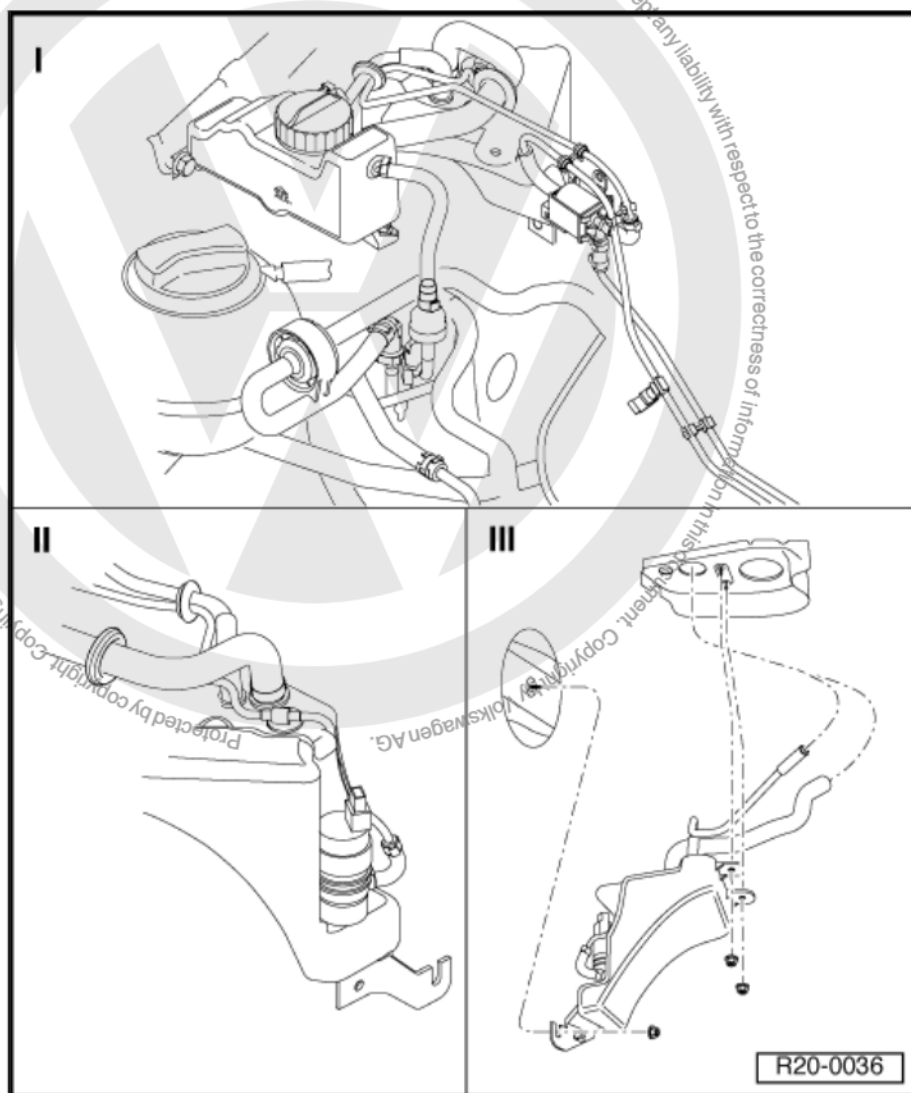


Note

Ensure the quick coupling is fully in place (fit-until hearing a typical "click").



## 1.5 Removing and installing parts of the lubrication system



Note

- ◆ Keep petrol tank always full at all year seasons.
- ◆ Cold start system works at temperature equal to or lower than 15°.



I ⇒ [page 90](#)

II ⇒ [page 90](#)

III ⇒ [page 91](#)

## 1.5.1 Part I

### Engine compartment

#### 1 - Petrol tank

#### 2 - Hose

- ☐ Petrol tank vent.
- ☐ Hose fastening with flex brace.
- ☐ Renew brace and install with pliers -VW 004V- or -V.A.G 1275- .

#### 3 - Hose

- ☐ Of petrol tank.

#### 4 - Cold start petrol tank

- ☐ To remove, remove right front wheel and housing liner ⇒ Rep. Gr. 66 ; Removing and installing wheel housing liner

#### 5 - Supply pipe

- ☐ For 3-way electromagnetic valve.

#### 6 - Airing pipe

- ☐ To air filter.

#### 7 - Supply pipe

- ☐ To butterfly body.

#### 8 - Cold start system electromagnetic valve

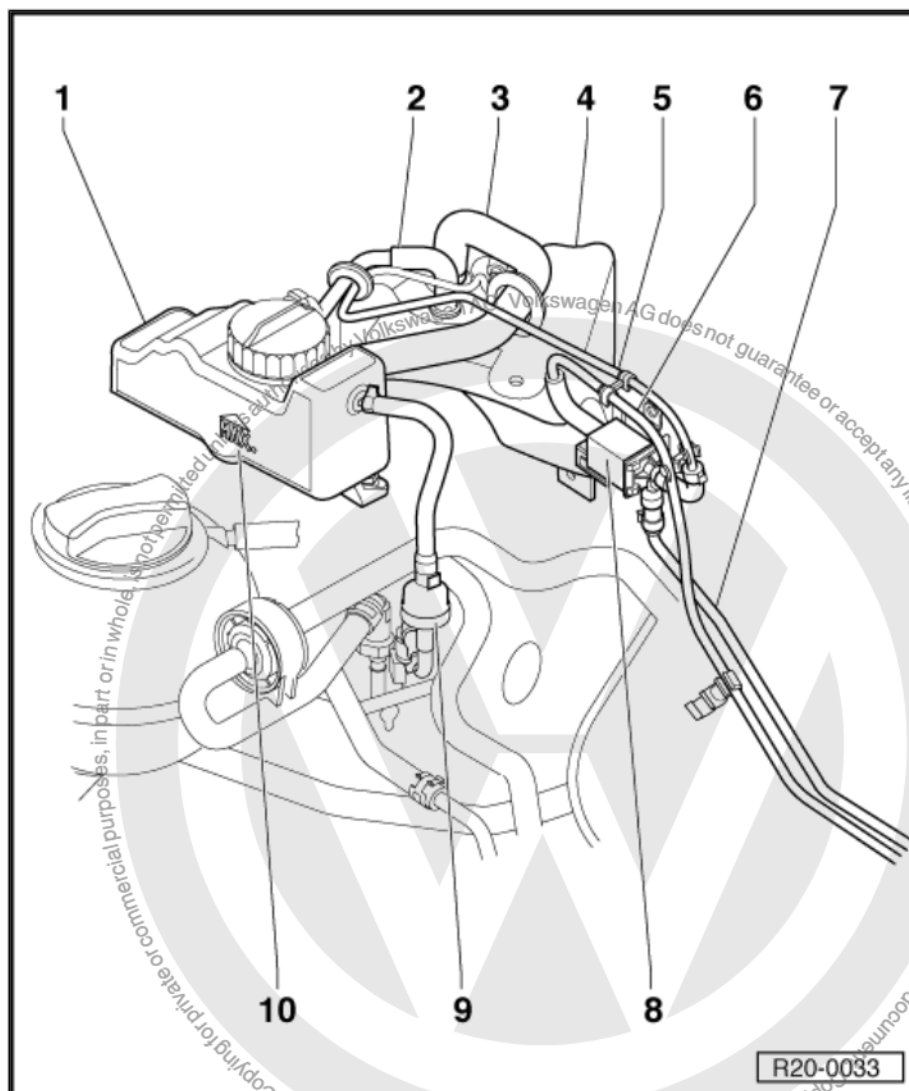
- ☐ 3-way.

#### 9 - Vent valve

- ☐ Unidirectional.
- ☐ To activated charcoal filter canister.
- ☐ Blue pipe.

#### 10 - Maximum supplying mark

- ☐ Do not exceed indication maximum limit.



## 1.5.2 Part II

### Right front wheel housing



## 1 - Seal

- ☐ Use neutral soap to facilitate installation.

## 2 - Hose

- ☐ Petrol tank vent.
- ☐ Hose fastening with flex brace.
- ☐ Renew brace and install with pliers -VW 004V- or -V.A.G 1275- .

## 3 - Hose

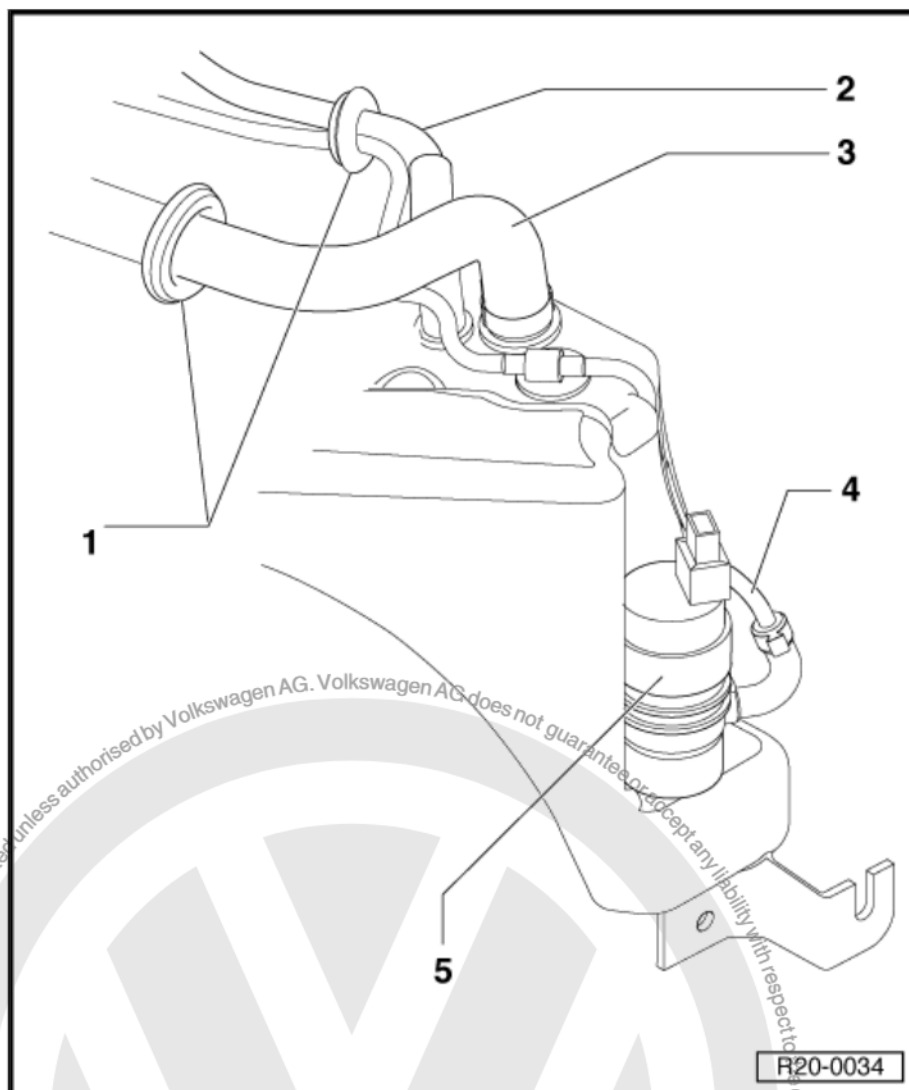
- ☐ For petrol tank filling.

## 4 - Tube

- ☐ Supplying.
- ☐ From pump to 3-way valve.

## 5 - Cold start petrol delivery unit

- ☐ To remove, disconnect from tank.



## 1.5.3 Part III

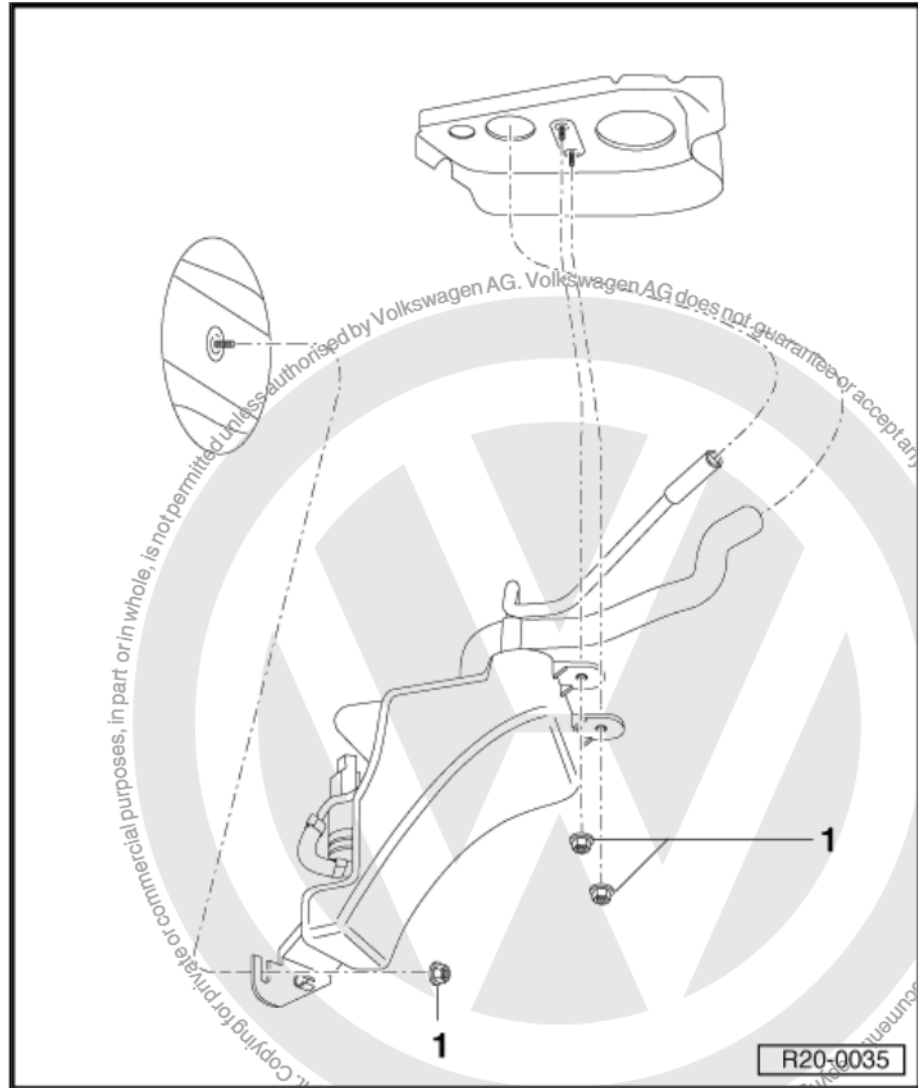
Right front wheel housing (petrol tank fastening).



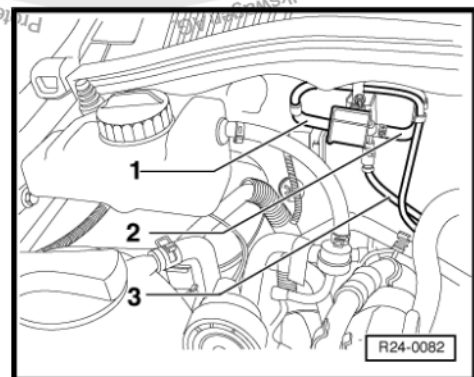


1 - 8.0Nm

- ❑ When installing tank, hoses and delivery unit must be installed.



- Hose positioning on cold start system electromagnetic valve  
1- Ventilation hose 2- Petrol tank hose 3- Hose from electromagnetic valve to intake collector.



## 1.6 Removing and installing fuel pump

Special tools and workshop equipment required



- ◆ Special socket -VW 5321/9-

V.A.G 1332



W00-0428

- ◆ Torque wrench (40...200Nm) -V.A.G 1332-

### 1.6.1 Removing

- Before starting removal jobs, follow safety recommendations ⇒ [page 86](#) .
- Respect cleaning rules ⇒ [page 87](#) .
- First, check if vehicle has code radio, if so consult anti-theft code.
- With ignition switched off disconnect battery earth strap.
- Fold back seat.
- Remove fuel pump access cover.



#### WARNING

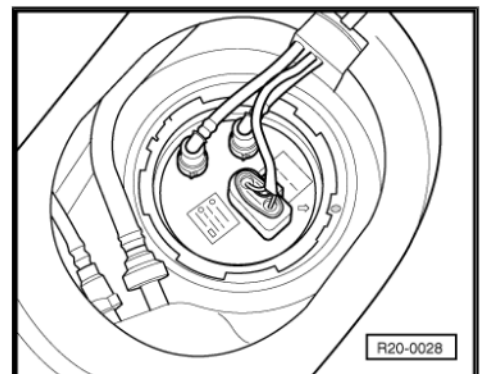
*Fuel supply hose is under pressure! Before loosening hose junctions, place a cloth around them. Next, eliminate pressure removing hose carefully.*

- Remove return pipe -1- , supplying pipe -2- and connector -3- from flange.



#### Note

*To remove fuel hoses, press safety ring that exists below connection.*



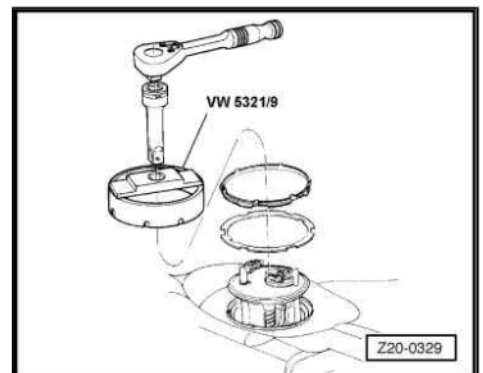
R20-0028

- Remove lock using -VW 5321/9- .
- Remove fuel delivery unit and sealing ring from fuel tank opening.



#### Note

*To replace fuel delivery unit, it is necessary to drain old unit before disposal.*



Z20-0329



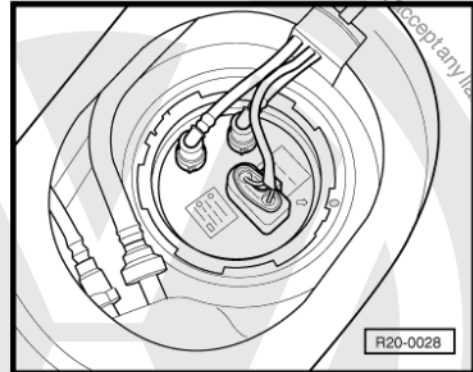
## 1.6.2 Installing

- Fuel delivery unit installation must be done in removal reverse order.



### Note

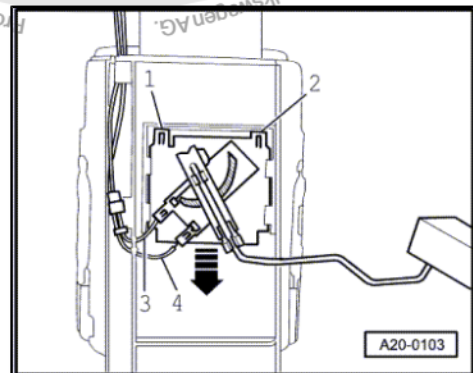
- ♦ Try not to fold fuel level sensor during installation.
- ♦ Place fuel pump seal dry on fuel container opening.
- ♦ Lubricate seal with fuel only for fuel delivery unit installation.
- ♦ Note installation position of flange of fuel delivery unit: Flange markings must coincide with mark on the body.
- ♦ Ensure firm seating of fuel hoses.
- ♦ Do not invert supply and return hoses.
- ♦ After fuel pump unit flange installation, check if supply, return and ventilation hoses are still fastened to fuel container.



## 1.7 Removing and installing fuel level sensor

### 1.7.1 Removing

- Remove fuel delivery unit ⇒ [page 92](#) .
- Disconnect and remove cable connector terminal locks -3- e -4-.
- Rise fasteners -1- and -2- with a screwdriver disconnect fuel level sensor downwards -arrows-.



### 1.7.2 Installing

- Place fuel level sensor on fuel delivery unit guides and push it upwards until it fits.

## 1.8 Removing and installing fuel tank

Special tools and workshop equipment required



- ◆ Torque wrench (5...50Nm) -V.A.G 1331-

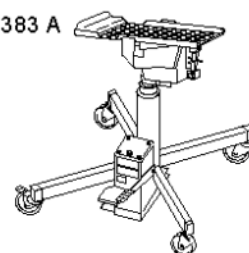
V.A.G 1331



W00-0427

- ◆ Lifter for engines and gearboxes -V.A.G 1383A-

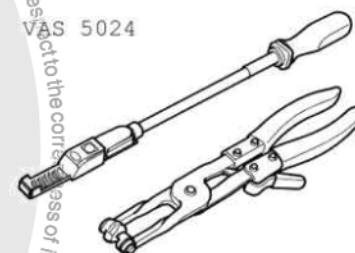
V.A.G 1383 A



W00-0120

- ◆ Pliers for springtype braces -VAS 5024- or -V.A.G 1921-

VAS 5024



W00-0495

### 1.8.1 Removing

#### Prerequisites

- The fuel tank may only be a maximum  $\frac{1}{2}$  full.



#### Note

- ◆ Drain fuel tank with fuel draining equipment -VAS 5190- .
- ◆ Before starting removal jobs, follow safety recommendations [⇒ page 86](#) .
- First, check if vehicle has code radio, if so consult anti-theft code.
- With ignition switched off disconnect battery earth strap.
- Remove cylinder head cover.
- Drain fuel tank and clean surroundings of filling nozzle.
- Fold back seat.

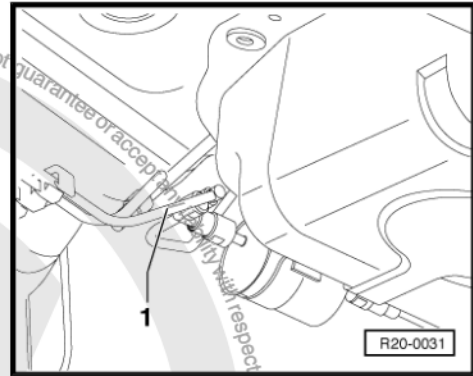


- Remove fuel delivery unit cover.
- Disconnect 4-pole connector from flange.
- Remove tank hoses near the delivery unit.
- Exhaust system must be fastened with metallic wire to the body, a bit lowered.
- Remove heat deflector between exhauster and fuel tank.
- Loosen filter supplying pipe -1-.
- Remove supplying pipe braces near the tank using pliers - VW 5024- or pliers -V.A.G 1921- .
- Loosen securing bolts, supporting fuel tank with engine and gearbox lifter -V.A.G 1383A- .
- Lower fuel tank.



#### WARNING

*Fuel supply hose is under pressure! Before loosening hose junctions, place a cloth around them. Next, eliminate pressure removing hose carefully.*



### 1.8.2 Installing

Install in removal reversed order, considering the following:

- ◆ Do not kink ventilation and fuel-hoses.
- ◆ Ensure firm seating of fuel hoses.



#### Note

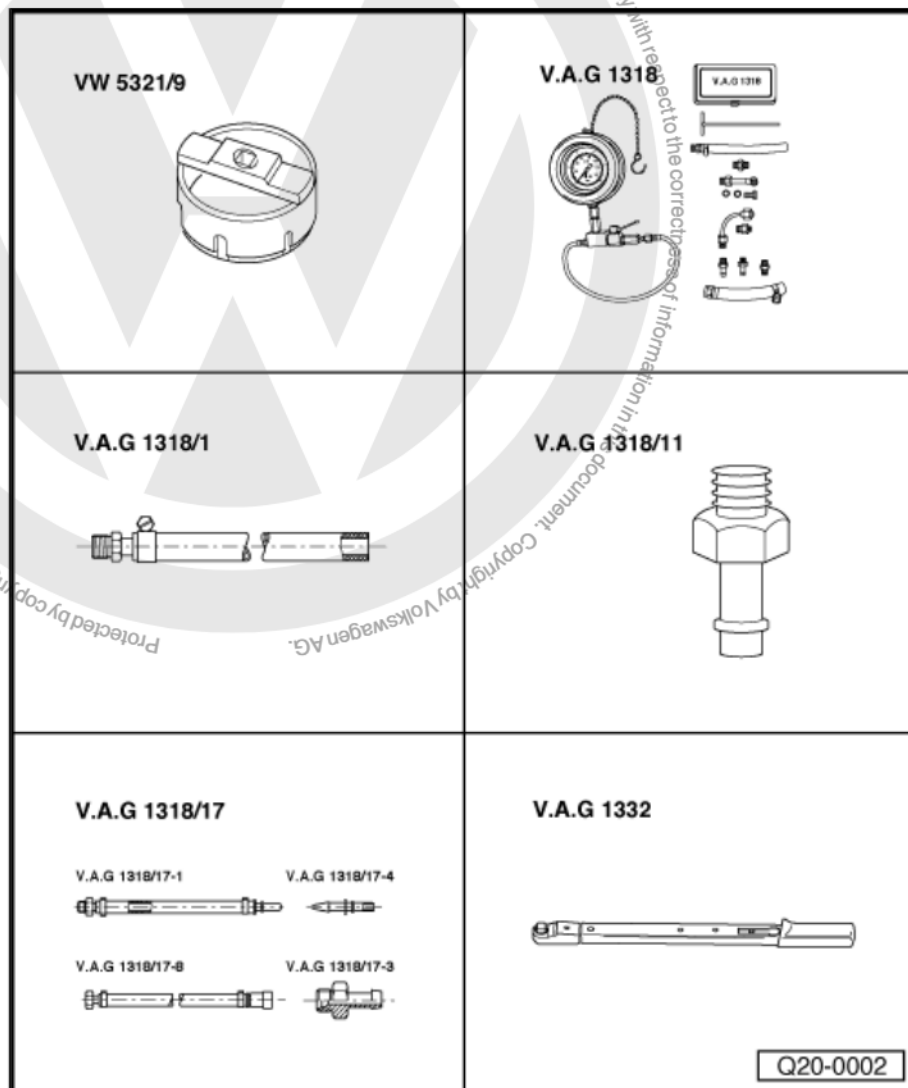
*Once fuel tank is installed, check whether supply, return and ventilation hoses continue fastened.*



## 1.9 Checking fuel delivery unit

Special tools and workshop equipment required

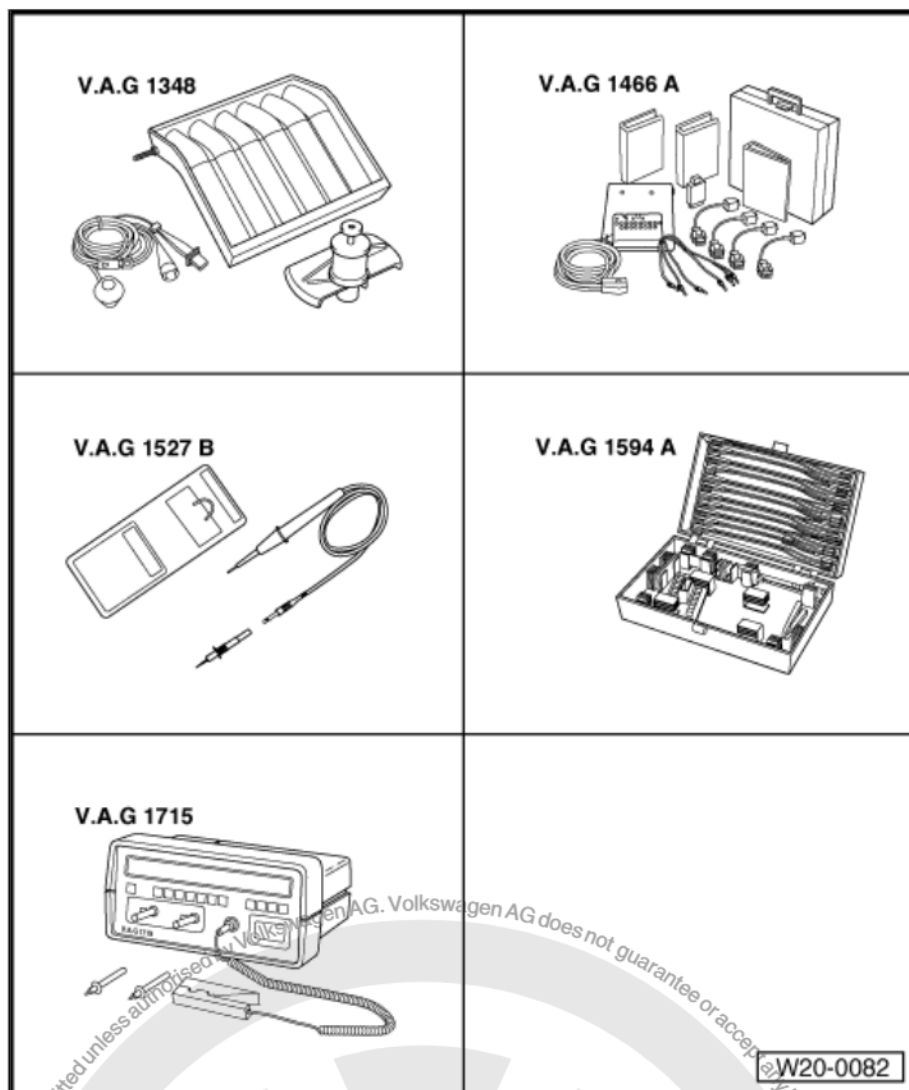
- ◆ Special socket - VW 5321/9-
- ◆ Manometer -V.A.G 1318-
- ◆ Adapter -V.A.G 1318/1-
- ◆ Adapter -V.A.G 1318/11-
- ◆ Adapter -V.A.G 1318/17-
- ◆ Torque wrench (40...200Nm) -V.A.G 1332-
- ◆ Fuel flow comparer - V.A.G 1348-



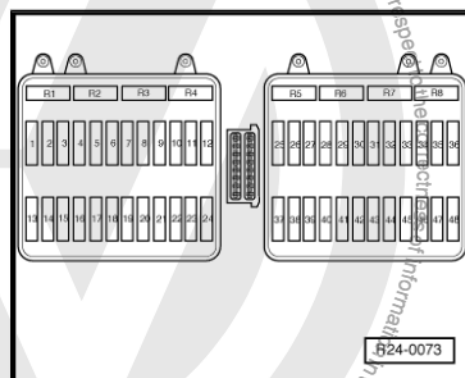


**Special tools and workshop equipment required**

- ◆ Test system - V.A.G 1466 A-
- ◆ Test LED -V.A.G 1527B-
- ◆ Auxiliary measuring set - V.A.G 1594A-
- ◆ Multimeter -V.A.G 1715-
- ◆ Graded container
- ◆ Current circuit scheme

**Checking conditions**

- Fuse no. 33, correct.
- Minimum battery voltage is 11.5 V.
- All power consuming components, like lights and rear window heating, must be off.
- In vehicles with air conditioning, it must be off.

**1.9.1 Check power supply operation****Note**

*To perform these jobs it is necessary to disconnect battery earth strap. To do so, first check whether vehicle is equipped with code radio. If so, previously consult anti-theft code.*



- Fold backseat forward.
- Remove cover below the seat.
- Turn on ignition system. The fuel pump must operate audibly. for a short time -approx. 1 second.

If fuel delivery unit does not work:

- Switch ignition off.
- Disconnect 1st. cylinder injector valve connector.
- Connect remote control -V.A.G 1348/3A- to 1st cylinder injector valve connector and red clamp to the battery, positive borne (+).
- Start remote control.

Fuel delivery unit operates normally:

- Ensure fuel delivery unit relay is operating, according to electric diagram, using -V.A.G 1466 A- : ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

If fuel delivery unit does not work:

- Disconnect 4-pole terminal connector on fuel delivery unit flange.
- Attach LED -V.A.G 1527 B- with auxiliary cables of -V.A.G 1594 A- to connector external contacts.
- Start remote control. LED must light up.

If the LED does not light up:

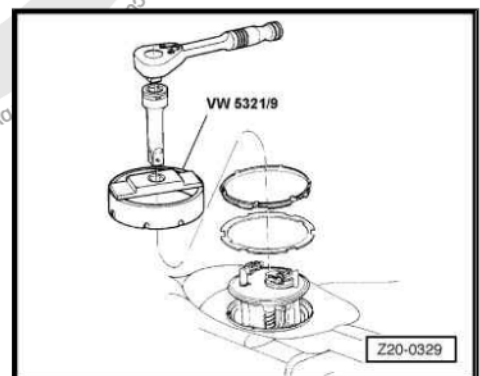
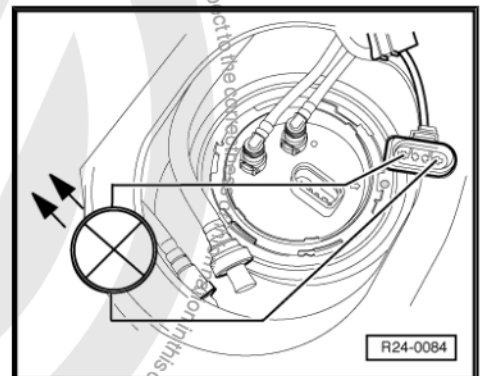
- Locate and correct cable interruption, according to current circuits scheme. ⇒ Current circuit diagram

LED lights up (correct electrical supply):

- Remove delivery unit using wrench -VW 5321/9- .
- Check if cables are connected between flange and fuel pump.

If cable interruptions are not detected:

- Renewing damaged fuel pump ⇒ [page 92](#)



## 1.9.2 Check fuel pump flow:

Checking conditions

- Fuel delivery unit supplying shows no irregularity.
- Remote control -V.A.G 1348/3A- , connected.

Check process

- Remove fuel supply nozzle lid.



**WARNING**

*Fuel supply pipe is under pressure. Before loosening hose joints, place a cloth around them. Next, release pressure by carefully loosening hose.*





- Connect checking manometer -V.A.G 1318- to fuel supply pipes, using adapters -V.A.G 1318/9- and -V.A.G 1318/17- .
- Connect hose -V.A.G 1318/1- to adapter -V.A.G 1318/11- of checking manometer and place its end into graded container.
- Open checking manometer valve. Lever will indicate flow direction -A-.
- Activate remote control -V.A.G 1348/3A- , slowly closing the valve, until manometer shows positive pressure equal to 2.8 to 3 bar. From this moment on, do not change valve position.
- Empty measuring container.
- The quantity of fuel delivered by the fuel delivery unit depends on the battery voltage. Because of that, it is necessary to connect the multimeter to vehicle battery using auxiliary cables of -V.A.G 1594 A- .
- Activate remote control for 30 seconds, and measure battery voltage.
- Compare fuel flow to theoretical value.

8) Minimum flow is 500 ml.

9) Fuel pump voltage with engine off and pump operating (approx. 2 volts below battery voltage).

#### Reading examples:

During checking, a 12.5 voltage is measured at the battery. As delivery unit voltage is 2 volts below battery voltage, the resulting flow is 200 cm minimum <sup>3</sup>/30 s.

If minimum flow is not reached:

- Check fuel pipe sets to ensure there are no kinks or interruptions.
- Separate fuel hoses -1- from fuel filter entry.



#### Note

*To do so, push keys on hose closures.*

- Connect to fuel supply pipe set the checking manometer -V.A.G 1318- , using adapter -V.A.G 1318/17- .
- Checking delivery rate.

If minimum flow is not reached:

- Renew the fuel filter.

If minimum flow is not reached:

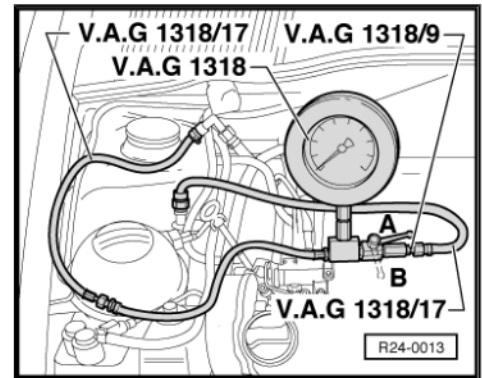
- Remove fuel delivery unit and check whether there is dirt in the filter.

Only if no irregularity has been observed this far:

- Fuel delivery unit defective, renew fuel delivery unit  
⇒ [page 92](#) , Removing and installing fuel delivery unit.

If desired fuel flow is reached, albeit with difficulty, it may be concluded that fuel supply has a fault (like fuel supply temporary fault):

- Connect again disassembled fuel pipes.

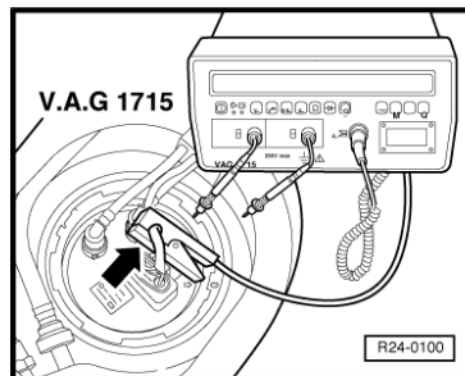




- Using current-stealing pincers, connect multimeter - V.A.G 1715- to 4-pole connector plug box cable contact 1 -arrow- of cable harness.
- Start engine and let-it run at low rpm.
- Measure the current draw of the fuel delivery unit. Specification: Maximum 8 amperes.

**Note**

*If it is a temporary fault in the fuel system, checking may also be done during test drive, and in that case the participation of a second person is necessary.*



If current consumption is excessive:

- Fuel delivery unit defective, renew fuel delivery unit  
⇒ [page 92](#) , Removing and installing fuel delivery unit.

### 1.9.3 Check fuel delivery unit retaining valve.

Checking conditions

- Remote control -V.A.G 1348/3A- , connected.
- Checking manometer -V.A.G 1318- , connected.

Check process

**Note**

*This test must simultaneously prove junctions of fuel supply pipes do not leak, from delivery unit to the checking manometer - V.A.G 1318- junction.*

- Close checking manometer valve (lever transversal to flow direction -position B-).
- Start remote control at short intervals, until reaching pressure equal to approx. 3.0 bar.

**WARNING**

*Risk of sprinkling when opening valve, place a container in front of checking manometer open junction.*

- Release possible excess pressure, opening valve carefully.
- Observe pressure drop in the manometer. After 10 minutes, pressure must not drop below 2.5 bar.

If pressure continues dropping:

- Check if junctions are blocked.

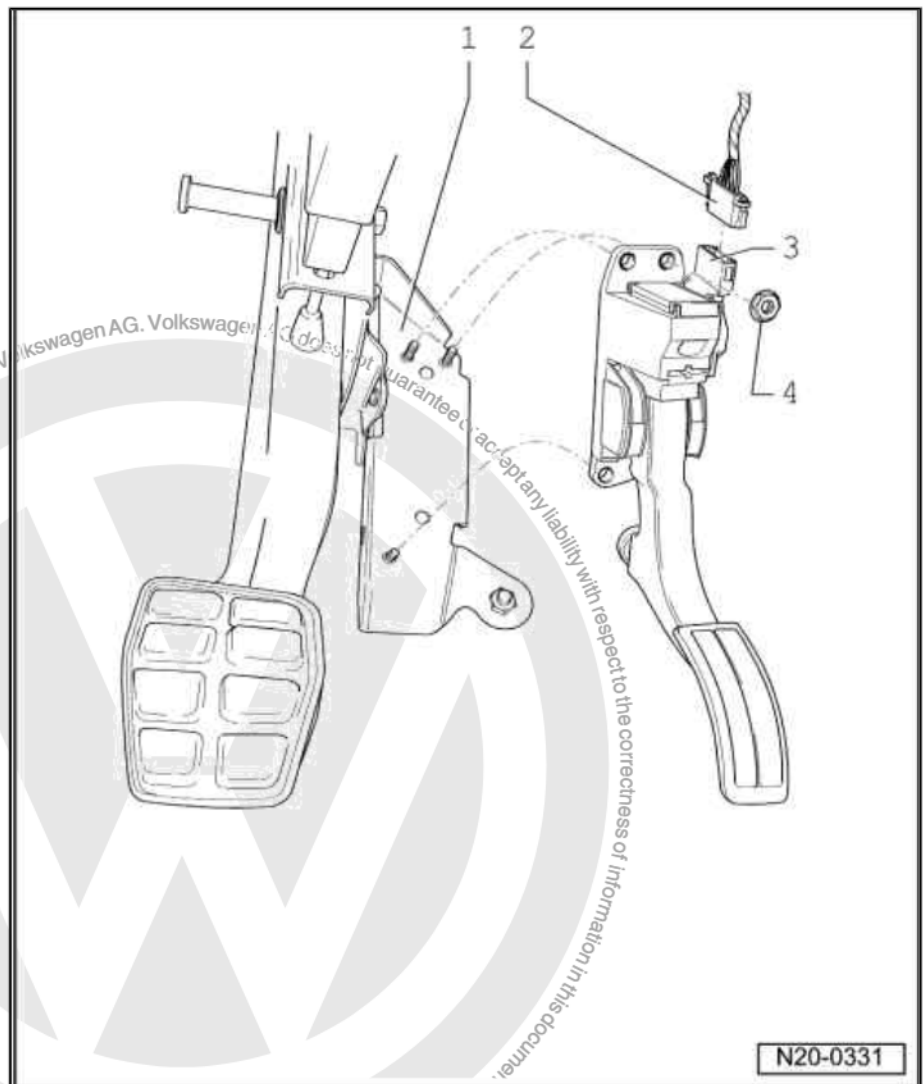
If no irregularity is found on the cables:

- Fuel delivery unit defective, renew fuel delivery unit  
⇒ [page 92](#) , Removing and installing fuel delivery unit.



## 2 Engine output electronic regulation (electronic throttle). check

- 1 - Pedals bracket
- 2 - Connector
  - Black, 6 poles.
- 3 - Throttle pedal position sensor ( -G79- and -G185- )
- 4 - 10Nm



### 2.1 Electronic throttle system operation (E-gas)

In the electronic throttle, butterfly valve is not started by cable. There is no mechanical connection between throttle and butterfly valve.

Throttle position is transmitted to the engine command equipment through two throttle position sensors (variable resistance, housed in a body), that are connected to throttle.

Throttle position (at driver's criteria) is a basic entrance figure to the engine command unit.

Butterfly valve is started by an electric engine (butterfly element) incorporated to the butterfly valve command unit, in all rotation and load intervals.

Butterfly valve is started by butterfly element, based on data supplied by engine command unit.

With engine off and ignition connected to engine control unit starts butterfly element based on the data communicated by throttle position sensor. That means that if throttle is half pressed, butterfly





element will open butterfly valve proportionally; and the butterfly valve will half open.

With engine rotating (with load), the engine command equipment may open or close the butterfly, regardless of throttle position transmitter.

This way, the butterfly valve may, for example, be completely opened, even if throttle is half activated. The advantage is the avoidance of losses due to choking, caused by butterfly valve.

Besides, consumption and pollutant emissions are reduced for certain load conditions.

Necessary torque may be obtained by engine command unit through optimal combination between butterfly valve opening and super-supply pressure.

It would be wrong to believe that the "electronic throttle" is formed only by one or two components. The electronic throttle is no more than a system that contains all components that contribute to determine the butterfly valve position in order to regulate and control, for example, the throttle position sensor, the throttle butterfly valve command unit, the light indicator EPC, the engine command unit, and so on).

Respect safety precautions ⇒ [page 86](#) .

Respect cleaning rules ⇒ [page 87](#) .



### 3 Activated charcoal system

#### 3.1 Operation

Depending on air temperature and pressure fuel fumes are formed above fuel container surface.

Activated charcoal system filter prevents these carbon hydroxide emissions to reach the air we breathe.

Fuel fumes reach, in reduced quantities, the activated charcoal filter, from the highest container points, through the gravity valve (that closes at a 45°) and the pressure maintaining valve.

Activated charcoal absorbs these fumes like a sponge.

During vehicle movement and with lambda regulation activated (hot engine), electromagnetic valve (-N80-, also called regeneration valve) is activated through pulses, depending on load or rotation, by engine command unit. Opening time depends on signals received.

During draining process (recovering of activated charcoal), clean air is absorbed through the ventilation port, on the activated charcoal filter bottom. The fuel vapours stored in the activated charcoal and fresh air are fed for combustion in dosed quantities.

Pressure maintaining valve avoids intake of fuel fumes when electromagnetic valve is opened and there is vacuum in the intake collector. This ensures priority to draining of activated charcoal filter.

Without current supply the electromagnetic valve is closed (power shortage, for example), and charcoal filter is not drained.



#### Note

- ◆ *Hose connections are fastened by springtype braces.*
- ◆ *To assemble spring braces, it is recommended the use of installation equipment -VAS 5024- or pliers -V.A.G 1921-.*

Respect safety precautions ➔ [page 86](#).

Respect cleaning rules ➔ [page 87](#).



### 3.2 Activated charcoal filter system components - repair

#### 1 - Ventilation tubes

- ❑ Ensure proper fastening.

#### 2 - Pressure retaining valve with linking hose

- ❑ Ensure proper fastening.
- ❑ Of gravity valve in the fuel container.

#### 3 - Activated charcoal filter

- ❑ Fitting location: on right rear wheel housing.

#### 4 - Ventilation connection

- ❑ Visible from below.

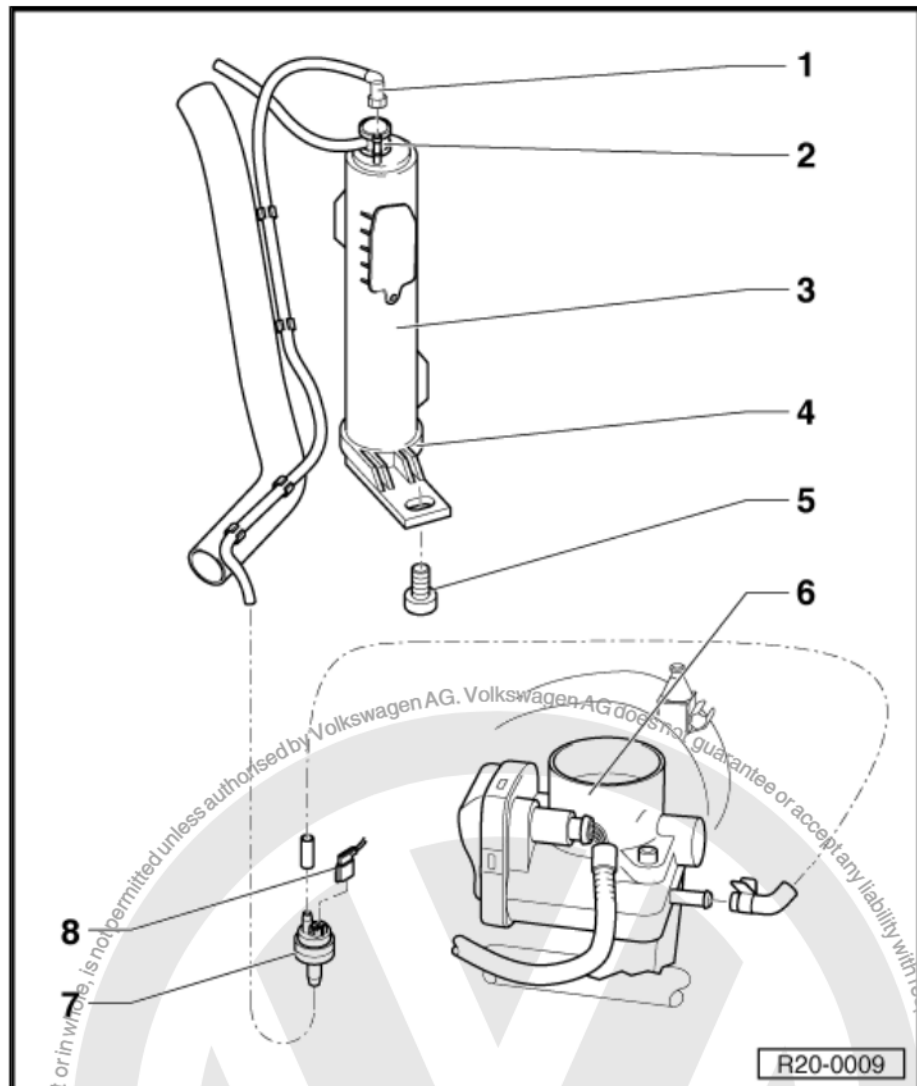
#### 5 - 10Nm

#### 6 - Intake collector with butterfly valve command unit

#### 7 - Electromagnetic valve 1 of activated charcoal filter -N80-

- ❑ Valve will close when ignition is off.
- ❑ Valve is activated (through pulses) by engine control unit, when engine is at operation temperature.

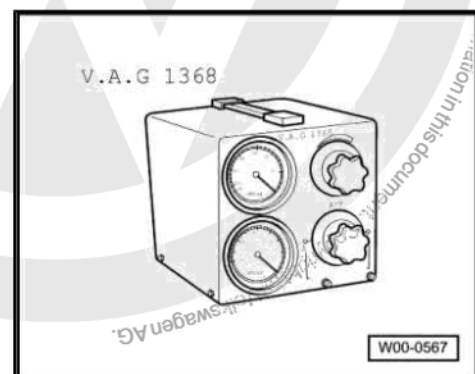
#### 8 - Connector



### 3.3 Fuel container ventilation - checking

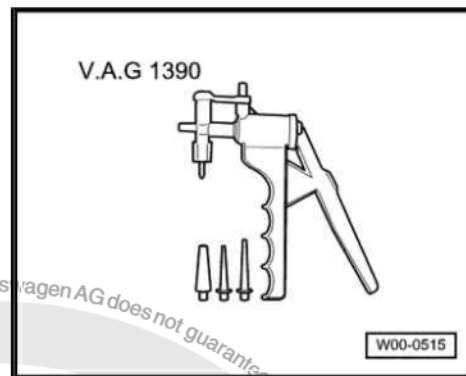
Special tools and workshop equipment required

- ♦ Vacuum meter -V.A.G 1368-





◆ Portable vacuum pump -V.A.G 1390-



Test conditions

- Ignition must be off.

Test sequence

- Loosen ventilation hose -1- of activated charcoal filter in the electromagnetic-valve -2-.
- Connect portable vacuum pump -V.A.G 1390- and vacuum meter -V.A.G 1368- as indicated on hose -1-.
- Place vacuum meter in position -A/B-.
- Repeatedly activate portable vacuum pump -V.A.G 1390-. No vacuum may be created.

If there is vacuum:

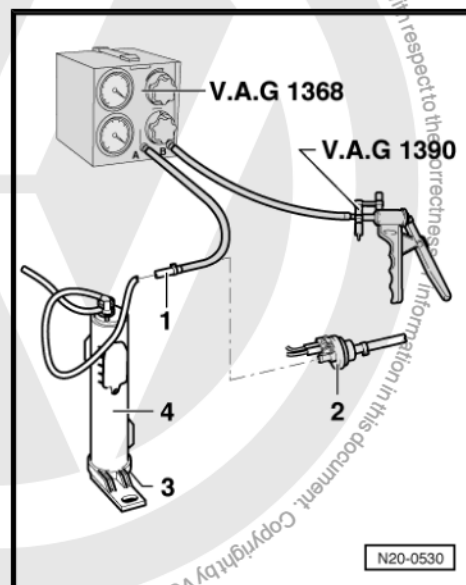
- Check if ventilation hose -3- of activated charcoal filter -4- is dirty, if necessary, clean it.

If there is no vacuum:

- Cover ventilation hose -3- and repeatedly start vacuum pump. Vacuum must be created.

If there is no vacuum:

- Renew activated charcoal filter.





## 24 – Mixture preparation, Injection

### 1 Servicing injection system

#### 1.1 General indications related to injection

- ♦ Engine command unit has a self-diagnosis system. Before performing repairs and for fault location, consult fault memory. Also the vacuum hoses and connections must be checked (unmetered air).
- ♦ Fuel hoses in the engine compartment must only be fastened with springtype braces. Use of retaining braces or bolt braces is not allowed.
- ♦ Minimum voltage of 11.5 V is necessary for the proper operation of electric components.
- ♦ Do not use sealants containing silicone. Silicone particles sucked by the engine are not burned and damage lambda probe.
- ♦ In case of power shortage or deletion of fault memory, code READINESS must be generated again.

READINESS code ⇒ [page 126](#)

Safety precautions ⇒ [page 116](#)

Cleaning rules ⇒ [page 117](#) .

Technical data ⇒ [page 117](#) .

#### 1.2 Component location

A and D components are not illustrated in the figure.



A - Brake pedal switch -F47- or brake light switch -F-

- ☐ Together in one housing in the footwell at the brake pedal.

B - Throttle pedal position sensor -G79- and -G185-

- ☐ In footwell, on throttle pedal ⇒ [page 103](#) .

C - Clutch pedal switch -F36-

- ☐ In footwell on clutch pedal.

D - Fuel pressure regulator

- ☐ In fuel delivery unit.

1 - Triple fitting connector

- ☐ Black.
- ☐ For engine rotation sensor -G28- .

2 - 4-pole connector

- ☐ Black.
- ☐ Replace intake collector pressure sensor -G71- with intake air temperature sensor -G42- .

3 - Intake manifold

- ☐ Removing and installing ⇒ [page 114](#) .

4 - Knock sensor 1 -G61-

- ☐ Fitting location: Engine block, intake side.

5 - Butterfly valve control unit -J338-

6 - Engine speed sender -G28-

- ☐ Fitting location: Engine block, intake side.

7 - Control unit

- ☐ Fit or remove connector only when ignition is switched off.
- ☐ Release to disconnect.

8 - Ignition transformer -N152-

- ☐ With codes for spark plug cables:
- ☐ ⇒ [Item 2 \(page 134\)](#) .

9 - Lambda probe 2 after catalytic converter -G39- , 50Nm

- ☐ Fitting location: On the exhaust pipe, near sleeve.

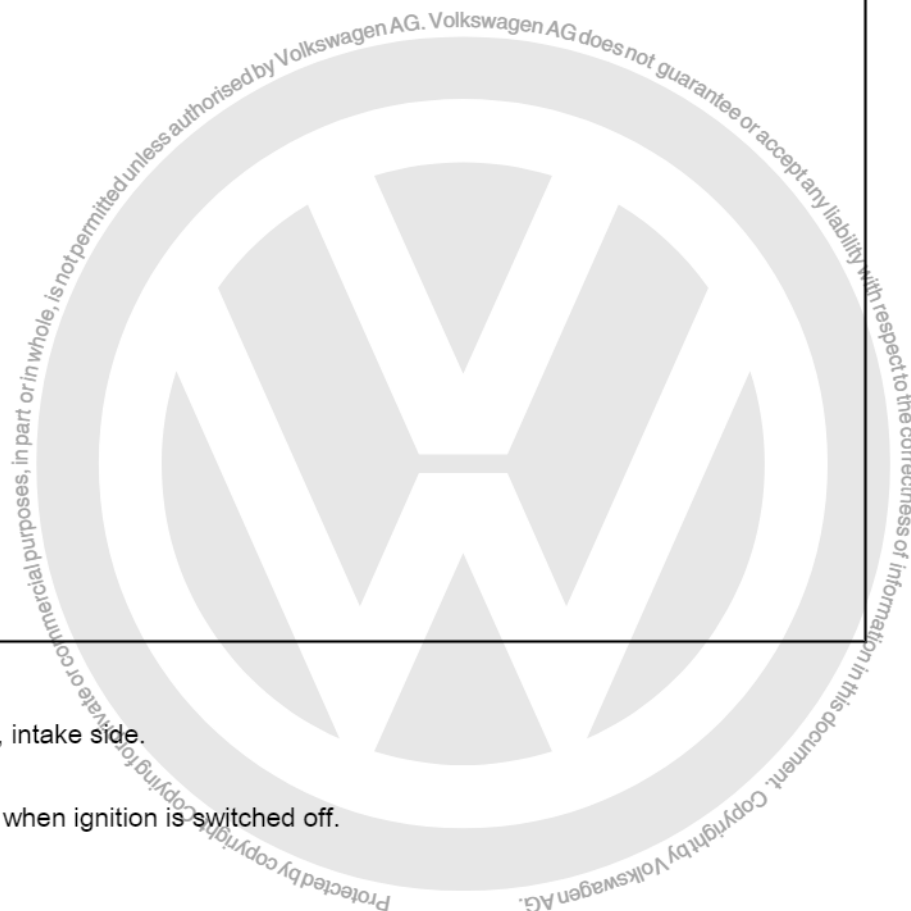
10 - Engine temperature sensor - -G62-

11 - Hall sender -G40-

- ☐ ⇒ [Item 8 \(page 134\)](#) .

12 - 4-pole connector

- ☐ Black.
- ☐ For Lambda probe 1 before catalytic converter -G39- and Lambda probe heater -Z19- .







13 - Exhaust collector

14 - Lambda probe 1 before catalyst -G39- , 50Nm

- ❑ Fitting location: On the exhaust pipe, front part, near the exhaust collector.

15 - Injector -N30- ... -N33-

16 - Fuel rail

17 - Electromagnetic valve 1 of activated charcoal filter -N80-

### 1.3 Removing and installing parts of the injection system

Component A is not represented in the figure.

A - Coolant temperature sensor -G62-

- ❑ Fitting location: On coolant hose, near the radiator.
- ❑ Of engine control unit.
- ❑ If necessary, depressurise system before removal.
- ❑ Resistance values between contact 1 and 2  
⇒ [page 112](#)
- ❑ Black connector, 2-pin.
- ❑ Connector contacts goldplated.

1 - Connector

- ❑ To engine command unit.
- ❑ Fit or remove connector only when ignition is switched off.
- ❑ Release to disconnect.

2 - Motronic control unit -J220-

- ❑ For injection system, lambda regulation, activated charcoal filter electromagnetic valve regulation, rotation limit, ignition and self-diagnosis.
- ❑ When replacing, adjust electronic gear blocking  
⇒ [page 128](#) adjust parts.

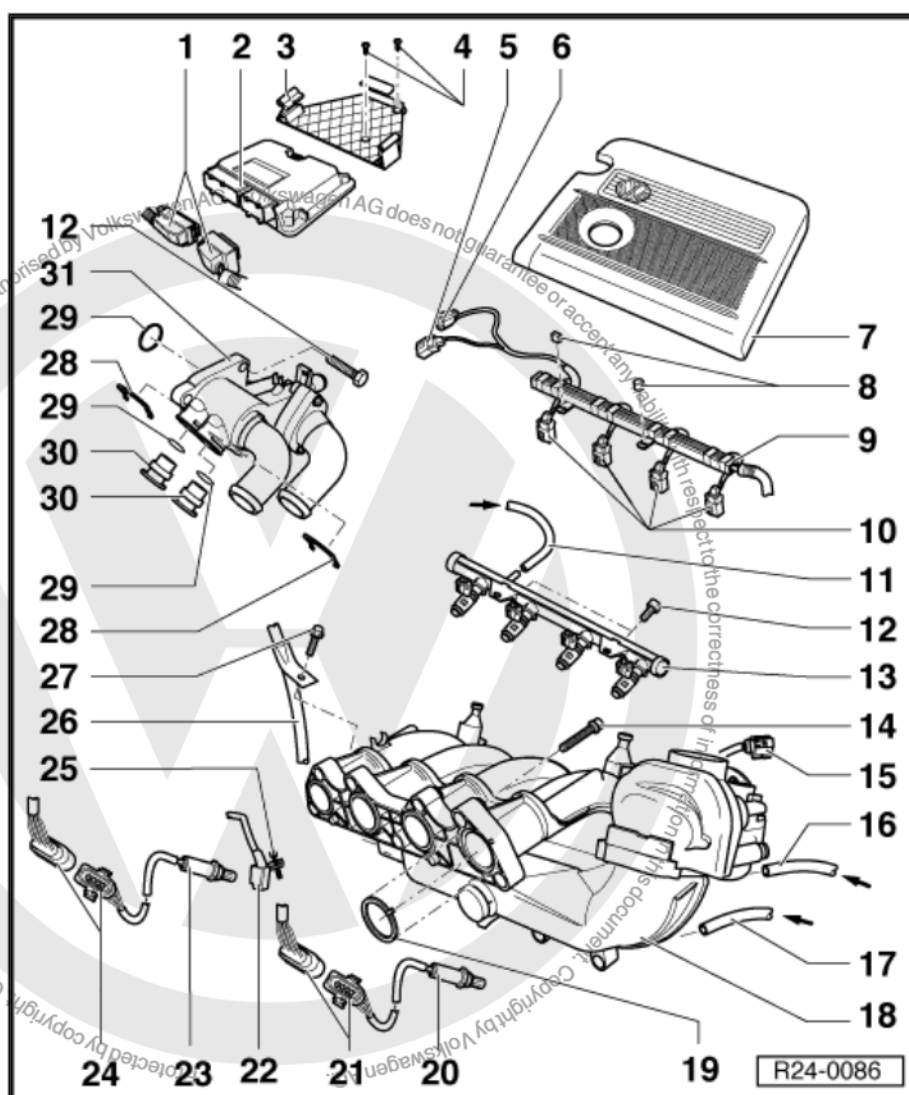
3 - Mounting plate

- ❑ Of engine control unit.

4 - 3Nm

5 - Connector

- ❑ Black, 4 poles.
- ❑ Replace intake collector pressure sensor -G71- with intake air temperature sensor -G42-.
- ❑ Connector contacts goldplated.





- 6 - Connector
  - ☐ Black, 3 poles.
  - ☐ Engine speed sensor -G28- .
- 7 - Air filter cover
  - ☐ Remove and install air cleaner set ⇒ [page 115](#) , ⇒ [page 115](#)
  - ☐ Dismantle and assemble ⇒ [page 114](#) .
- 8 - Securing clip
  - ☐ Observe model.
- 9 - Cable guide
  - ☐ Fastens to fuel rail.
- 10 - Connector
  - ☐ Black, 2 poles.
  - ☐ Of injector -N30- ... -N33- .
- 11 - Entrance pipe
  - ☐ Black with white marks.
  - ☐ Fasten with springtype braces.
  - ☐ Ensure proper fastening.
  - ☐ From fuel filter.
- 12 - 10Nm
- 13 - Fuel distributor with injectors
  - ☐ Removing and installing ⇒ [page 114](#) .
- 14 - 20Nm
- 15 - Connector
  - ☐ Black, 6 poles.
  - ☐ Butterfly valve control unit -J338- .
  - ☐ Connector contacts goldplated.
- 16 - From electro-magnetic valve to activated charcoal filter -N80-
  - ☐ Fasten with springtype braces.
- 17 - From power brake
- 18 - Intake manifold
  - ☐ Dismantling and assembling ⇒ [page 113](#) .
- 19 - O-ring
  - ☐ Renew.
  - ☐ Observe installation position.
- 20 - Lambda probe 1 before catalytic converter -G39- , 50Nm
  - ☐ Fitting location: On front exhaust tube.
  - ☐ Lubricate only thread with "G 052 112 A3"; not contacting probe body slots.
  - ☐ Remove and install with wrench set for lambda probe -3337- .
  - ☐ Electric feeding of probe heating through fuel delivery unit relay -J17- .
- 21 - Four fitting connector
  - ☐ Black.
  - ☐ For lambda probe before catalyst -G39- and lambda probe heaters -Z19- .
  - ☐ Contacts 3 and 4 are gold plated.
- 22 - Engine speed sensor -G28-
  - ☐ Fitting location: Engine block, intake side.

**23 - Lambda probe 2 after catalyst -G39- , 50Nm**

- ☐ Fitting location: On the exhaust pipe, near sleeve.
- ☐ Lubricate only thread with "G 052 112 A3"; not contacting probe body slots.
- ☐ Electric feeding of probe heating through fuel delivery unit relay -J17- .
- ☐ When removing, remove lower cover on right side of floor and 4-pin connector cover of lambda probe.
- ☐ Remove and install with wrench set for lambda probe -3337- .

**24 - Four fitting connector**

- ☐ Brown.
- ☐ For lambda probe 2 after catalyst -G39- and lambda probe heaters -Z19-
- ☐ Contacts 3 and 4 are gold plated.

**25 - 5Nm****26 - Guide tube**

- ☐ To oil measuring stick

**27 - 3Nm****28 - Retaining clip**

- ☐ Ensure proper fastening.

**29 - Washer**

- ☐ Renew.

**30 - Sealing plug**

- ☐ If necessary, depressurise system before removal.

**31 - Coolant thermostatic valve body****Resistance values of coolant temperature sensor -G62-**

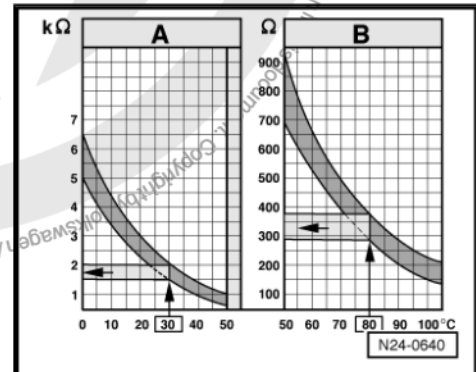
Diagram is divided into two temperature ranges:

A - of 0...50°C

B - of 50...105°C

Example:

- ◆ 30°C is in area A and corresponds to a 1.5...2.0k resistance  $\Omega$ .
- ◆ 80°C is in area B and corresponds to a 275...375 resistance  $\Omega$ .





## 1.4 Intake manifold - remove and install

### 1 - O-ring

- ☐ Renew if damaged.

### 2 - Butterfly valve command unit -J338-

- ☐ When replacing, adjust engine control unit to butterfly control unit  
⇒ [page 128](#) adjust parts.

### 3 - 10Nm

### 4 - 20Nm

### 5 - Intake manifold

### 6 - O-ring

- ☐ Renew.
- ☐ Observe installation position.

### 7 - O-ring

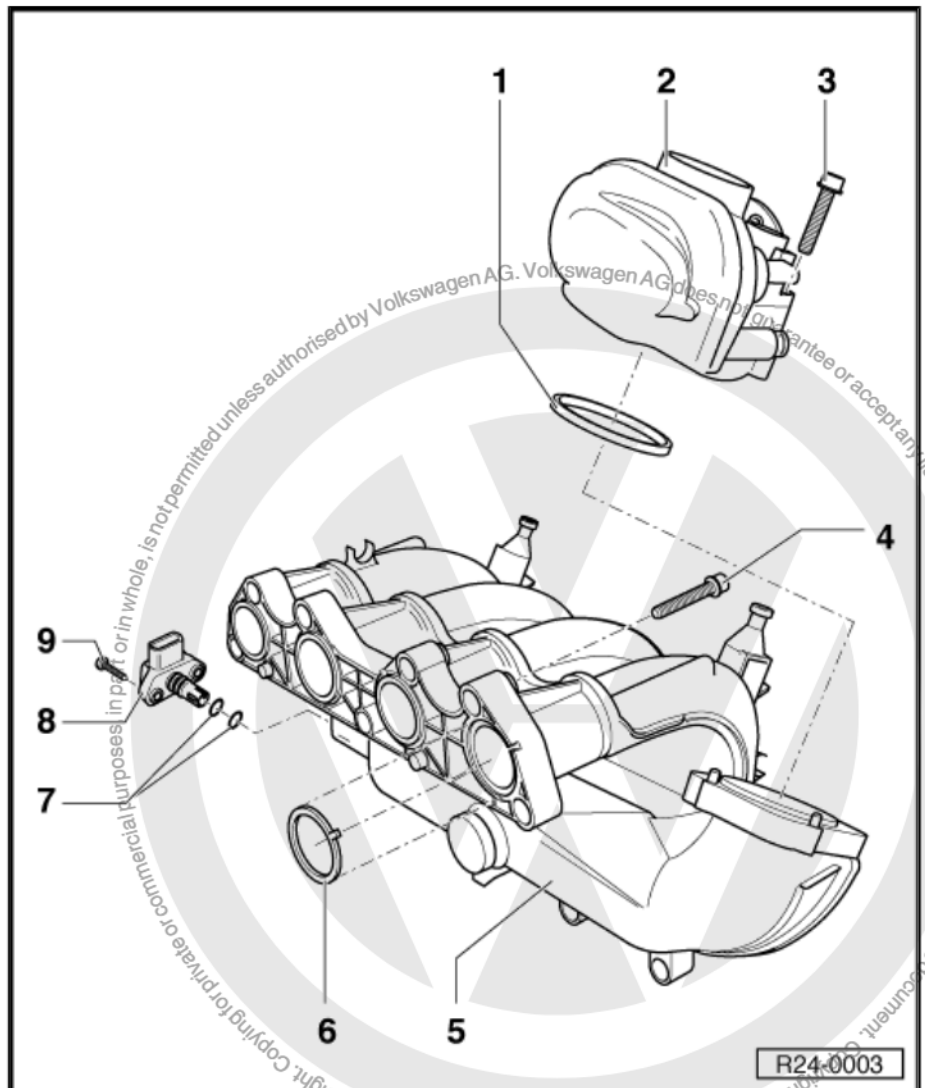
- ☐ Renew if damaged

### 8 - Intake collector pressure sensor -G71- with intake air temperature sensor -G42-

- ☐ Temperature sensor resistance values of intake air between contact 1 and 2 ⇒ [page 113](#)

### 9 - 3Nm

- ☐ Respect installation indications ⇒ [page 115](#).



Resistance values for intake air temperature sensor -G42-

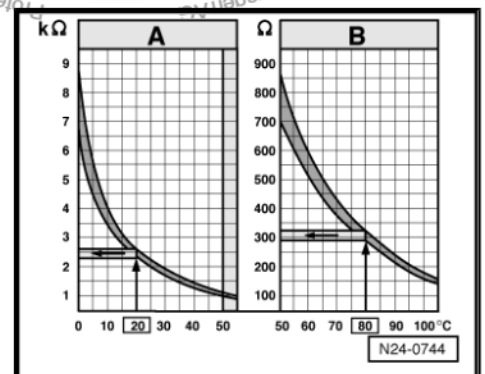
Diagram is divided into two temperature ranges:

A - of 0...50°C

B - of 50...105°C

Example:

- ◆ 20°C is in area A and corresponds to a 2.3...2.6k resistance  $\Omega$ .
- ◆ 80°C is in area B and corresponds to a 290...330 resistance  $\Omega$ .





## 1.5 Fuel distributor with injectors - remove and install

### 1 - Fuel rail

- ☐ Remove and install  
⇒ [page 119](#), injectors -  
check blast image and  
leak-proof capability.
- ☐ Check fuel pressure  
regulator ⇒ [page 121](#),  
check fuel pressure, fuel  
pressure regulator and  
retaining pressure.

### 2 - 10Nm

### 3 - Retaining clip

- ☐ Ensure proper fasten-  
ing.
- ☐ Ensure correct installa-  
tion on injector and fuel  
rail.

### 4 - O-ring

- ☐ Renew if damaged.
- ☐ Before installation  
slightly lubricate with  
clean engine oil.

### 5 - Injection valve -N30- ... - N33-

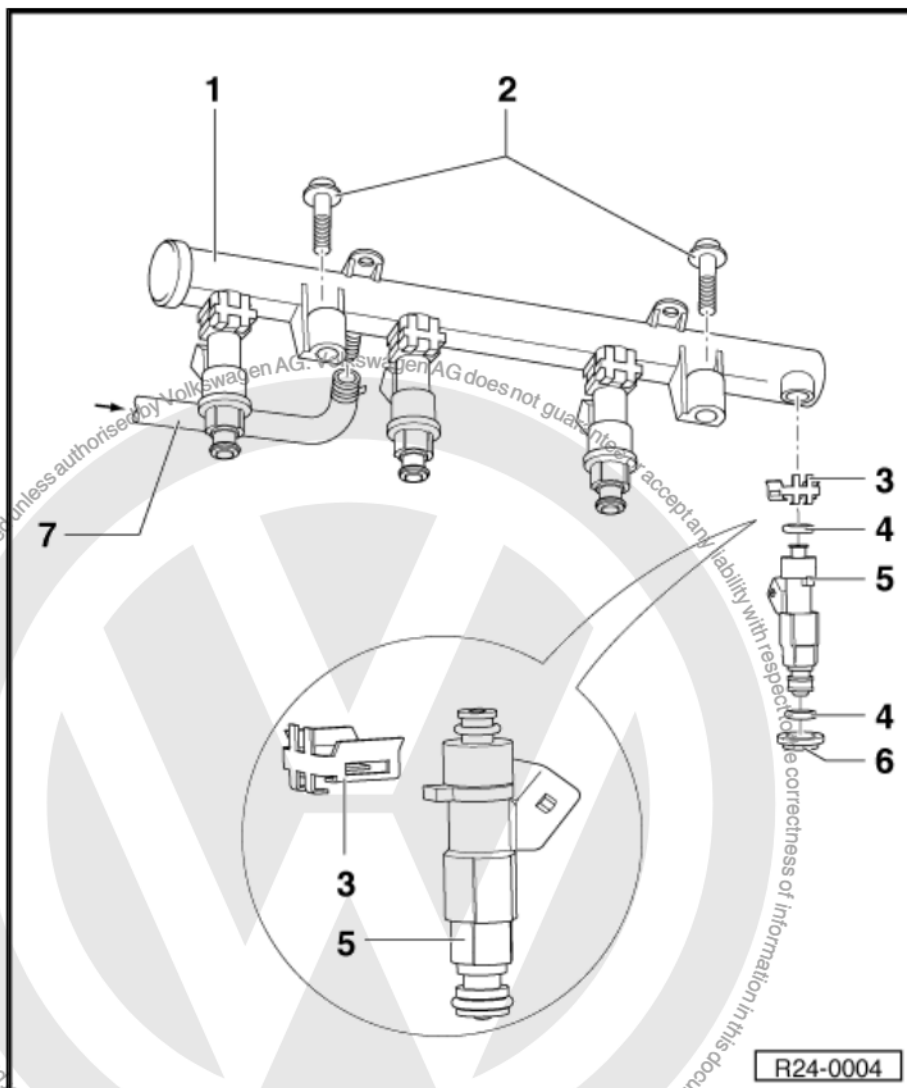
- ☐ Resistance between  
valve contacts: 12...  
17Ω.

### 6 - O-ring

- ☐ Observe installation po-  
sition.
- ☐ Renew when damaged.

### 7 - Brake pipe

- ☐ Black with white marks.
- ☐ Fasten with springtype braces.
- ☐ Ensure proper fastening.
- ☐ From fuel filter.



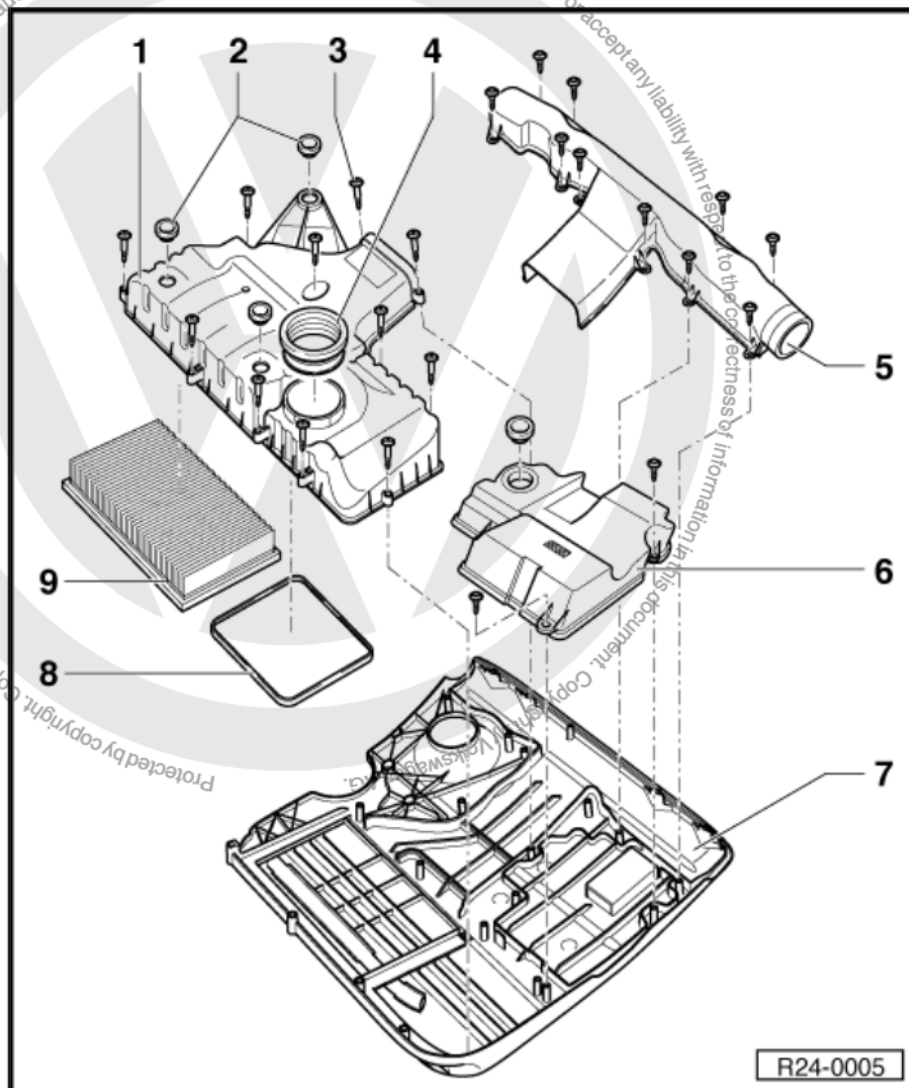
## 1.6 Dismantling and assembling air filter set

Removing and installing air cleaner body ⇒ [page 115](#), fig.  
⇒ [page 115](#)

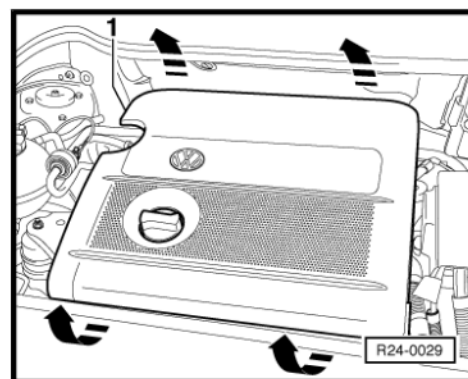




- 1 - Lower part of air cleaner body
- 2 - Rubber bushing
- 3 - 3Nm
  - ☐ Respect installation indications ➔ [page 115](#).
- 4 - O-ring
  - ☐ Ensure proper seating.
  - ☐ Renew when damaged.
- 5 - Air intake nozzle
- 6 - Cover
- 7 - Air filter body upper part
- 8 - Sealing gasket
  - ☐ Observe installation position.
  - ☐ Renew when damaged.
- 9 - Filter element



#### Removing and installing air cleaner body



#### 1.6.1 Removing

- Remove sump vent hose -1- from air cleaner body.
- Remove air cleaner body from supports and butterfly valve control unit and then from front supports -arrows-.

#### 1.6.2 Installing

- Air cleaner installation happens in removal reverse order.



## Note

- ◆ To fasten upper part of cleaner cover to cleaner cover base, and intake air nozzles and intake pressure air temperature sensor to intake manifold, self-locking bolts series are used. If these bolts are loosened or tightened with screwdriver, threads on upper part of filter body may be damaged.
- ◆ Use of a screwdriver is only allowed when:
- ◆ Screwdriver rotation is at most 200rpm,
- ◆ Adjusted torque of at most 3Nm.

## 1.7 Safety precautions

**WARNING**

*Fuel system is under pressure! Before loosening hose connections or opening checking junction, place a cloth around connections. Next, eliminate pressure, carefully removing hose and loosening closing bolt.*

To avoid personal injury and/or injection and ignition system damages, observe the following:

- ◆ For safety reasons, fuse 33 must be removed from fuse box before fuel system is opened.
- ◆ Do not touch or remove ignition cables with engine running or when starting engine.
- ◆ Connect or disconnect injection and ignition system cables (including cables of measuring equipment) only with ignition off.

**WARNING**

*For removal jobs, especially in the engine compartment, due to reduced existing space, consider the following:*

- ◆ All hoses (fuel, hydraulics, activated charcoal filter system, coolant and refrigerant, brake fluid vacuum) and electric cables must be restored to original positions.
- ◆ Ensure easy access to mobile parts that may be hot.

If during a test drive it is necessary to use test and measuring equipment, consider the following:

- ◆ Test and measuring equipment must be placed on the back seat to be used by a second mechanic.

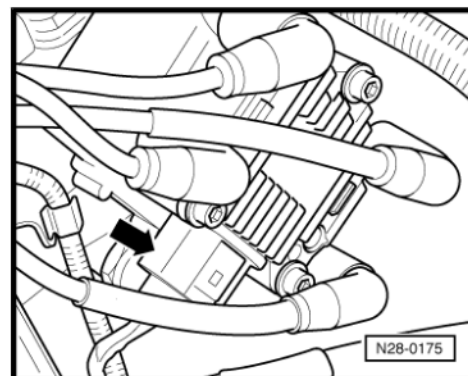
If test and measuring equipment are operated on passenger seat, person seating there may be injured due to airbag activation in case of accident.

- ◆ If engine must be in starting rotation without really running:





- Disconnect 4-pole connector from ignition transformer  
-arrow-.

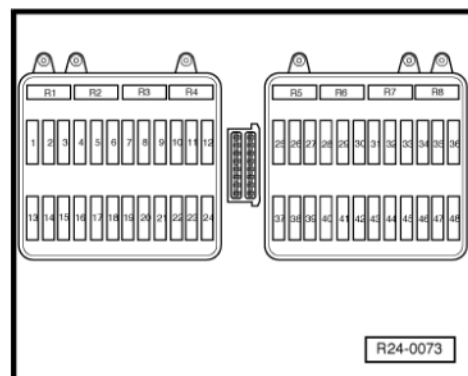


- Remove from fuse holder fuse number 33.



#### Note

*When fuse 33 is removed, power supply to injectors is interrupted.*



## 1.8 Rules for cleanliness

For jobs on the fuel/ injection system, strictly observe the "5 cleaning rules":

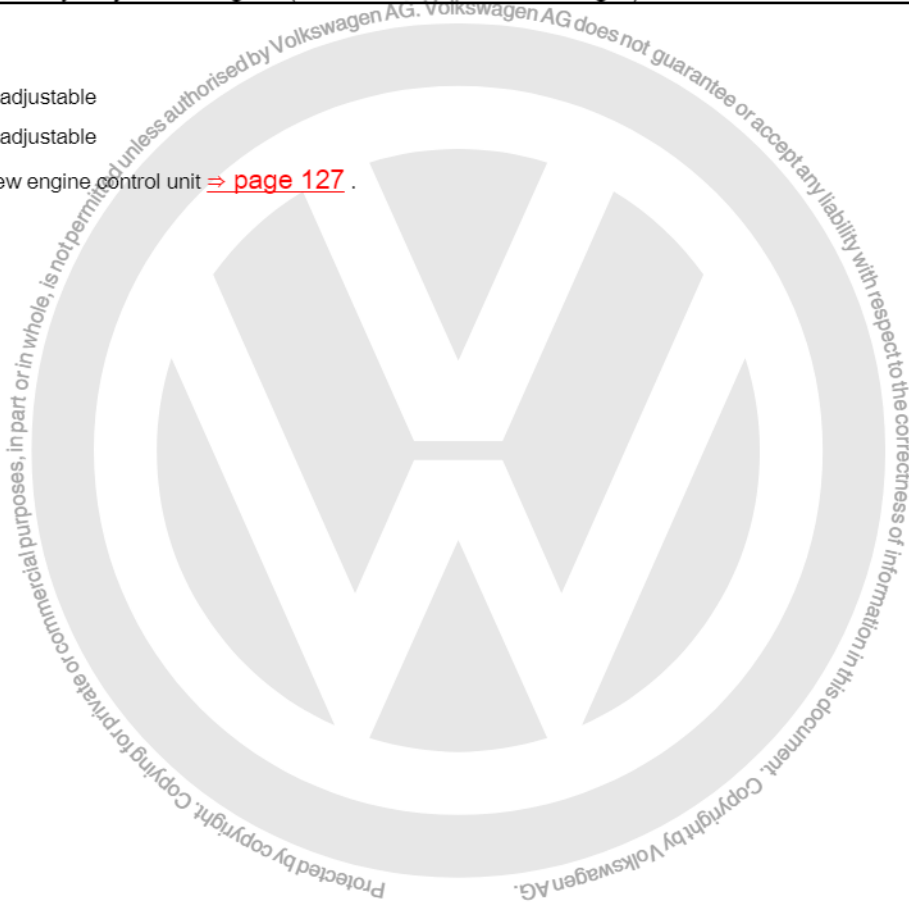
- ◆ Deeply clean connections and surrounding areas before disconnecting them.
- ◆ Place parts on clean surface and cover them. Use only lint free clothes!
- ◆ If repair jobs are not going to be carried out immediately, components removed from packaging must be covered or carefully preserved.
- ◆ Install only clean components. Remove spare parts from packaging shortly before installing them. Do not install components that have been kept out of packaging (i.e. inside the tool box, etc.).
- ◆ With system open: If possible, avoid using compressed air. If possible, do not move vehicle.

## 1.9 Technical data

Engine identification letters		BLH
Perform slow gear checking		
Idling speed <sup>(1)</sup>	rpm	850 <sup>(10)</sup>
Engine control unit <sup>(12)</sup>		
System		ME 7 5 10 Bosch
Part number of spare part		⇒ spare parts CD
Rotation limit	rpm	From approximately 5700



- 10) Non adjustable
- 11) Non adjustable
- 12) Renew engine control unit ➔ [page 127](#) .

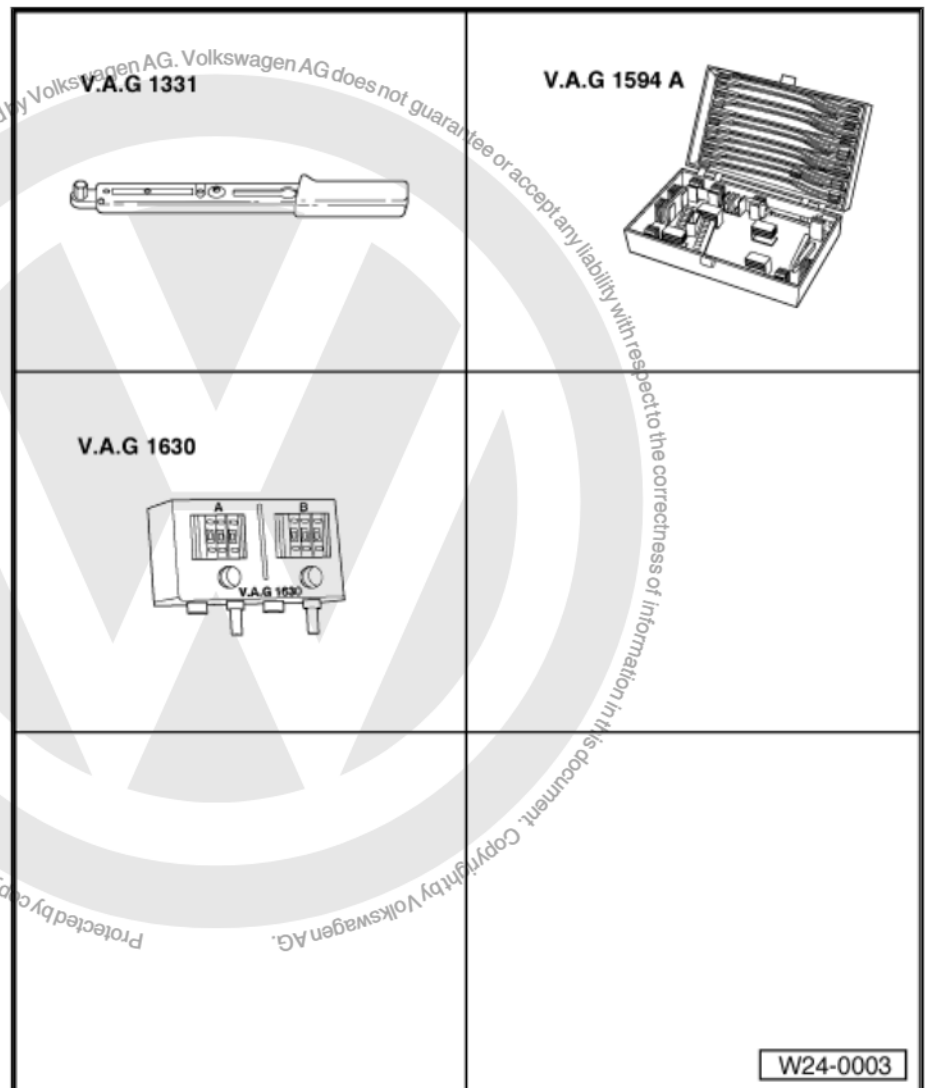




## 2 Component checking

### 2.1 Checking injection valves

Check blast shape and leak-proof capability



Special tools and workshop equipment required

- ◆ Torque wrench (5...50Nm) -V.A.G 1331-
- ◆ Auxiliary measuring cables set -V.A.G 1594A-
- ◆ Digital power meter -V.A.G 1630-
- ◆ Graded container.

Test conditions

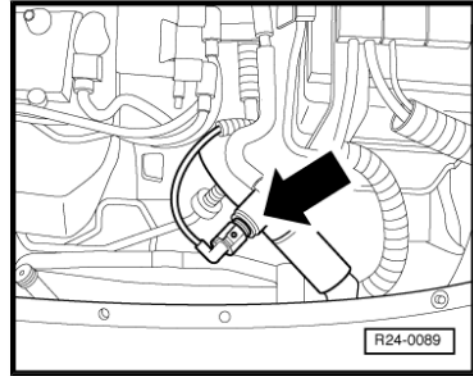
- Fuel pressure must be right, check ⇒ [page 121](#) , Check fuel pressure regulator and retaining pressure.

Test sequence

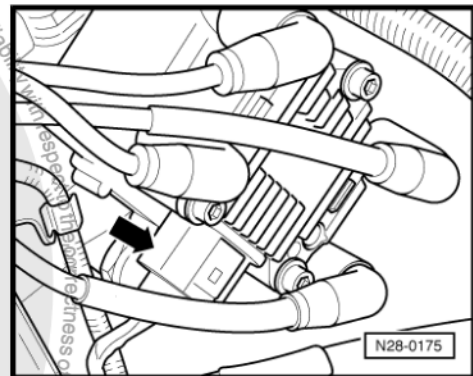
- Remove air cleaner set ⇒ [page 115](#) .



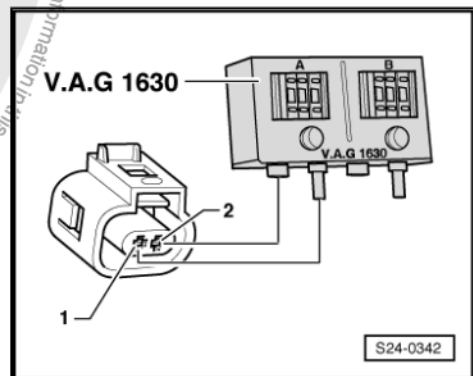
- Disconnect 4-pin connector of coolant temperature sensor - G62- -arrow-.



- Disconnect 4 pin connector of ignition transformer -arrow-.



- Couple digital power meter -V.A.G 1630- with auxiliary cables -V.A.G 1594- to contacts 1+2 of connector using and adjust connected side to 15kΩ.
- Disconnect injector harnesses on the fuel rail.
- Remove from head the complete fuel rail with all engine head injectors (fuel hoses remain coupled).





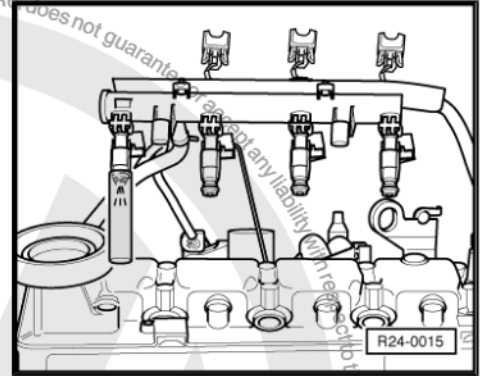
- Keep a small graded container under the injection valve to be tested and remove connectors from remaining injection valves.
- A second person must activate start engine. Injection valve must inject intermittently.
- Repeat check on the other injectors. Ensure only injector being tested is connected.
- Next, check injectors leak-proof capability. Maximum allowable leak is 2 drops/minute.

If the fuel loss is greater:

- Switch ignition off.
- Renew defective injector.

Installation happens in removal reversed order, considering the following:

- ◆ Renew O-rings on all injectors and moisten then lightly with clean engine oil before installation.
- ◆ Insert injectors vertically in correct position into fuel distributor, and immobilise with safety fasteners.
- ◆ Install fuel rail with injectors on engine head and press evenly.

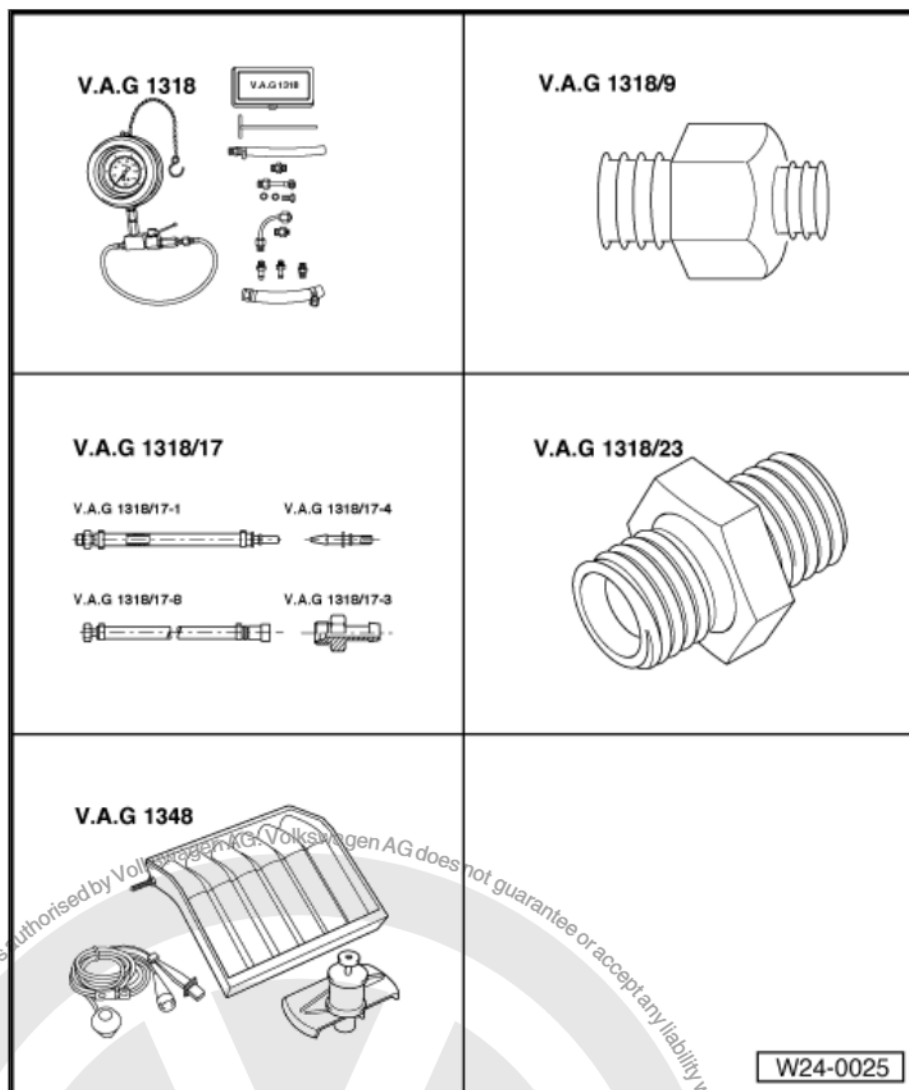


## 2.2 Fuel pressure regulator and retaining pressure - check



Note

- ◆ Fuel pressure regulator adjusts fuel pressure to around 3 bar.
- ◆ Fuel pressure regulator is in the fuel pump.



#### Special tools and workshop equipment required

- ◆ Checking manometer -V.A.G 1318-
- ◆ Adapter -1318/9-
- ◆ Adapter -1318/17-
- ◆ Adapter -1318/23-
- ◆ Remote control -V.A.G 1348/3-

#### Test sequence

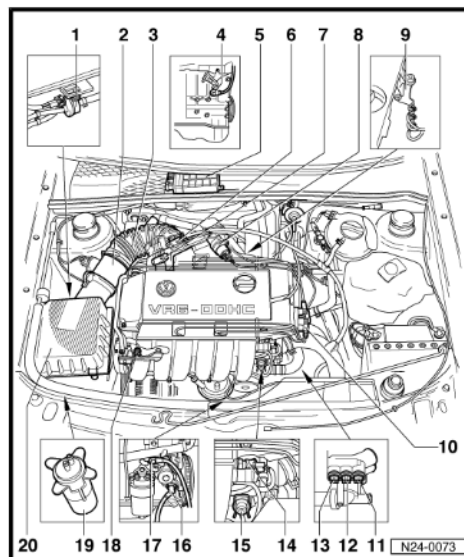
- Remove fuse box cover.



- Remove fuse 33 (fuel delivery unit) from fuse holder.

**WARNING**

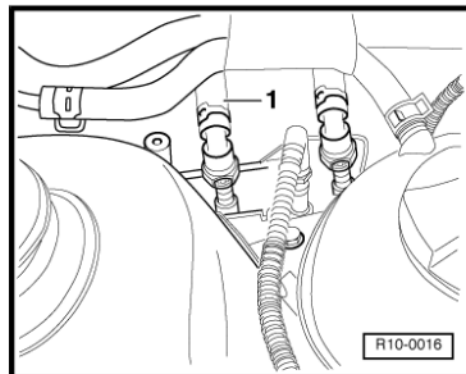
*Fuel system is under pressure! Before loosening hose connections or opening checking junction, place a cloth around connections. Next, eliminate pressure, carefully removing hose and loosening closing bolt.*



- Separate fuel intake pipe connection -1- and collect any released material with a cloth.

**Note**

*To unlock fuel ducts, push safety ring.*



- Connect manometer -V.A.G 1318- with adapter - V.A.G 1318/9- and -1318/17- .
- Open pressure measuring valve. The lever points in direction of flow.
- Place fuse 33 (fuel pump) in the fuse holder.
- Start engine and let it run in slow gear.
- Measure fuel pressure. Specification: approx. 3.0 bar

If theoretical value is not reached:

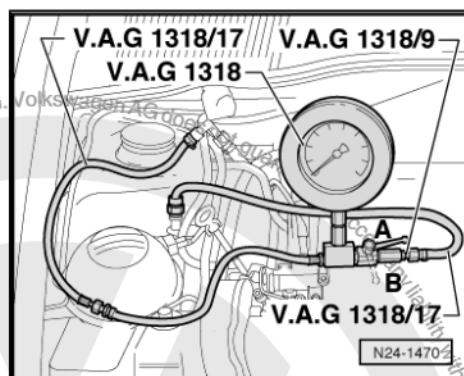
- Switch ignition off.
- Check whether fuel pump generates and maintains this pressure ⇒ [page 97](#) , Check fuel pump retaining valve.
- Check fuel pressure regulator and retention pressure ⇒ [page 124](#)

If theoretical value is reached:

- Switch ignition off.
- Check leak-proof capability and retaining pressure, controlling pressure drop in the manometer. After 10 minutes, minimum 2.0 bar pressure must be reached.

If retaining pressure falls below 2 bar:

- Start engine and run it in slow gear.



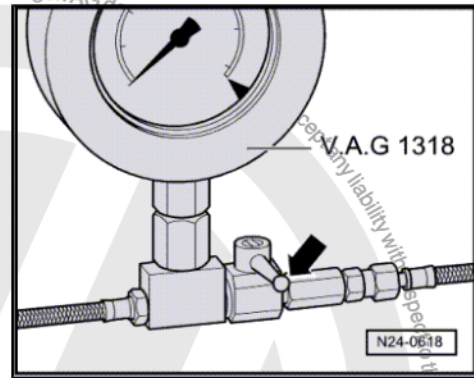




- When pressure is reached, turn ignition off, and at the same time close checking manometer -V.A.G 1318- passage (lever transversal to flow direction -arrow-).
- Observe pressure drop in the manometer.

If the pressure drops again:

- Check pipe connections, O-rings on fuel manifold and injectors for leaks.
- Check manometer leak-proof capability.



#### Note

*Before removing manometer, place clothes around hose junctions.*

If the pressure does not drop:

- Check whether fuel pump generates and maintains this pressure ⇒ [page 102](#) , Check fuel pump retaining valve.
- Check fuel pressure regulator ⇒ [page 124](#) .

## 2.2.1 Check fuel pressure regulator

### Test conditions

- Fuel delivery unit retaining valve OK, check ⇒ [page 102](#) .

### Test sequence

- Switch ignition off.
- Disconnect 1st. cylinder injector valve connector.
- Connect remote control -V.A.G 1348/3A- to 1st cylinder injector valve connector and red clamp to the battery, positive borne (+).



### WARNING

*Fuel system is under pressure! Before loosening hose connections or opening checking junction, place a cloth around connections. Next, eliminate pressure removing hose carefully.*



- Disconnect intake tubes -1- from fuel filter entrance.
- Return pipe -2- (blue) keep connected.
- Filling pipe -3- (black) keep connected.
- Filling pipe (filter outlet to engine) -4- connect to measuring equipment outlet.

**Note**

*To unlock fuel ducts, push safety ring.*

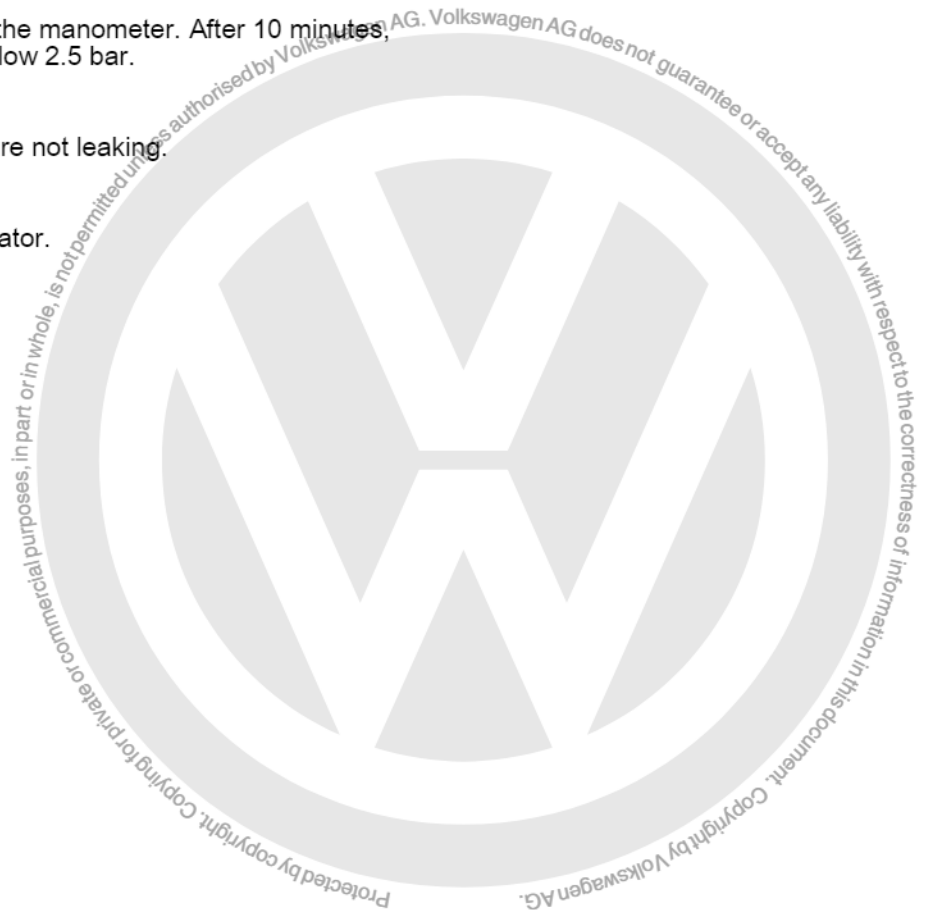
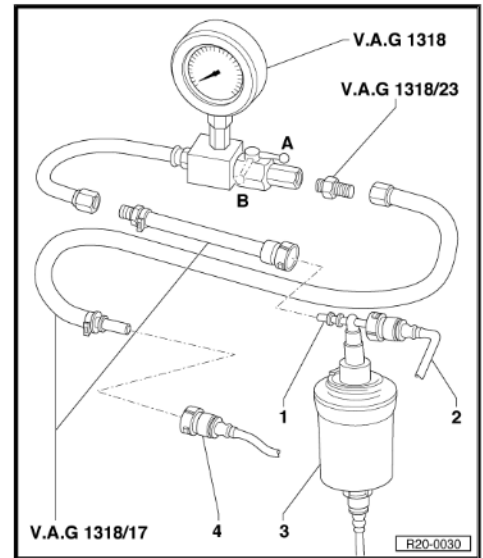
- Connect pressure meter -V.A.G 1318- with adapters - V.A.G 1318/23- and -1318/17- as shown.
- Close pressure measuring device valve (lever transversal to flow direction -position -B-).
- Start remote control -V.A.G 1348/3A- for approximately 10 seconds to fill fuel filter and generate a pressure of approximately 3.0 bar in the system.
- Observe pressure drop in the manometer. After 10 minutes, pressure must not drop below 2.5 bar.

If the pressure drops further:

- Ensure pipe connections are not leaking.

If no pipe fault is detected:

- Renew fuel pressure regulator.





### 3 Código READINESS

#### Function

Code READINESS is an 8 digit code that indicates diagnosis status of exhaust gases.

When a system diagnosis (like: secondary air system) is successfully accomplished, corresponding digit of number code changes status.

Diagnosis are performed regularly during normal operation. After repair of an exhaust gas system it is recommended that the READINESS code is generated, as that ensures the systems operate as expected. If during a diagnosis a fault happens, it is stored in the fault memory.

READINESS code is erased every time the fault memory is deleted or whenever there is a power shortage.

#### 3.1 Read and generate READINESS code

⇒ Diagnosis system VAS 5051





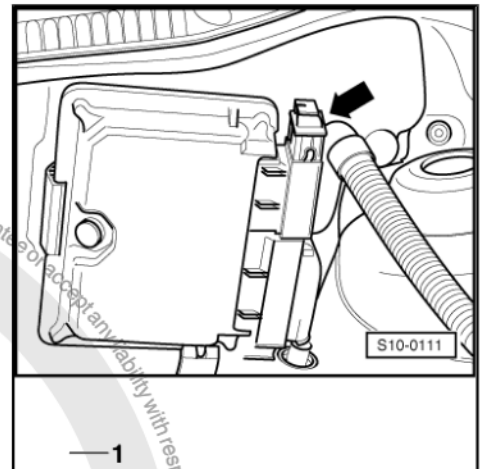
## 4 Engine control unit

### 4.1 Removing and installing engine control unit

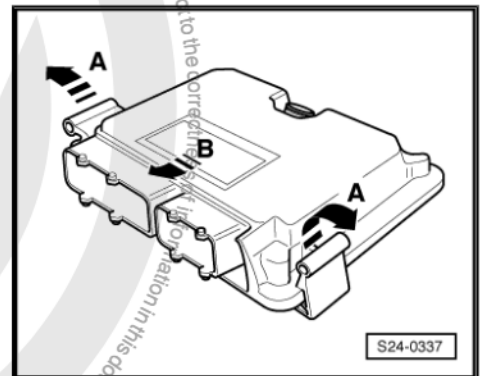
- Before removing the engine control unit interrogate the control unit identification and thereby the previous control unit coding ⇒ [page 128](#) ; Interrogating and erasing engine control unit fault memory.

#### 4.1.1 Removing

- Switch ignition off.
- Disconnect connector from engine control unit and remove it.



- Press clamps -arrows- outward and pull control unit sideways.

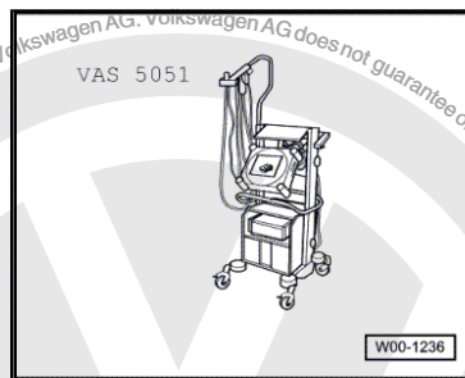


#### 4.1.2 Installing

- Install new control unit and push it to the left.
- Connect connector and lock it.
- Adjust command unit ⇒ [page 128](#) ; Adjust components.
- Interrogate fault memory of new engine control unit and, if necessary, delete fault memory ⇒ [page 128](#) .
- Perform test drive.



- Again interrogate the control unit fault memory.



## 4.2 Adjust components

### Special tools and workshop equipment required

- ♦ Vehicle information, measurement and diagnosis system - VAS 5051-
- ♦ Diagnosis cable -VAS 5051/1- or -VAS 5051/3-

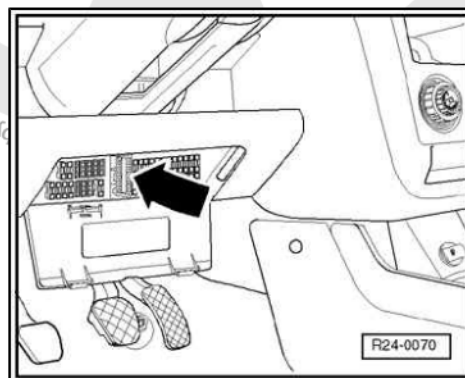
### Work sequence

- Connect vehicle measuring, diagnosis and information system -VAS 5051- in the following way:
- Install diagnosis cable connector -VAS 5051/1- or -VAS 5051/3- on diagnosis connection.

Select -VAS 5051- "Guided fault location" on the diagnosis equipment.

After all control units have been interrogated:

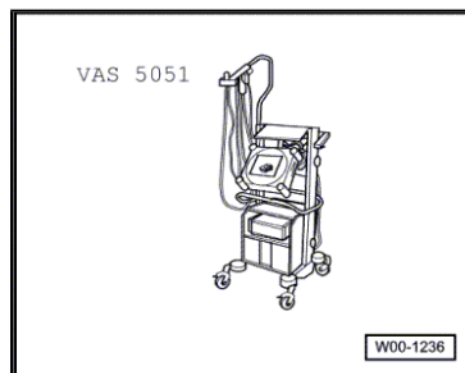
- Press key **Skip**.
- Select **Function selection/component**.
- Select **starting**.
- Select **engine identification codes**.
- Select **systems with selfdiagnosis**.
- Select **engine control**.
- Select **functions**
- Select **function or component**



## 4.3 Again interrogate the control unit fault memory.

### Special tools and workshop equipment required

- ♦ Vehicle information, measurement and diagnosis system - VAS 5051-





◆ Diagnostic cable -VAS 5051/1- or -VAS 5051/3-

Work sequence

- Connect vehicle measuring, diagnosis and information system -VAS 5051- in the following way:
- Connect diagnosis cable connector -VAS 5051/1- or -VAS 5051/3- to diagnosis connection.
- Start engine and let it run idle.

Only if engine does not work (start):

- Turn ignition on.

Select operation type:

- Press **Vehicle self-diagnostic** on the display.

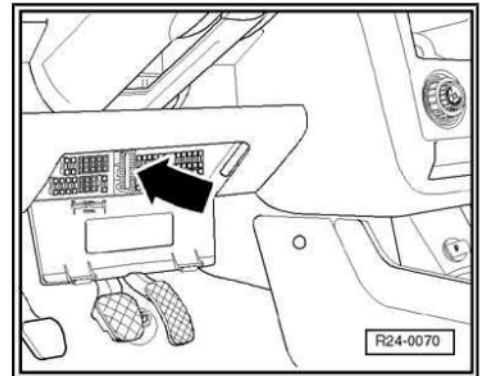
Selecting vehicle system:

- Press on display **01 Engine electronic system**.

The display shows control unit identifications and engine control unit code.

Selecting diagnosis function:

- Press 02 **Interrogate fault memory** on the display.
- If no faults are stored in engine command unit, the display shows "0 faults found".
- If there are faults stored in engine command unit, they will appear sequentially on display.
- Press key **↵**.
- Press on display **05 Delete fault memory**.
- Press key **06 Finish test**.





## 26 – Exhaust system

### 1 Removal and installing of exhaust system parts

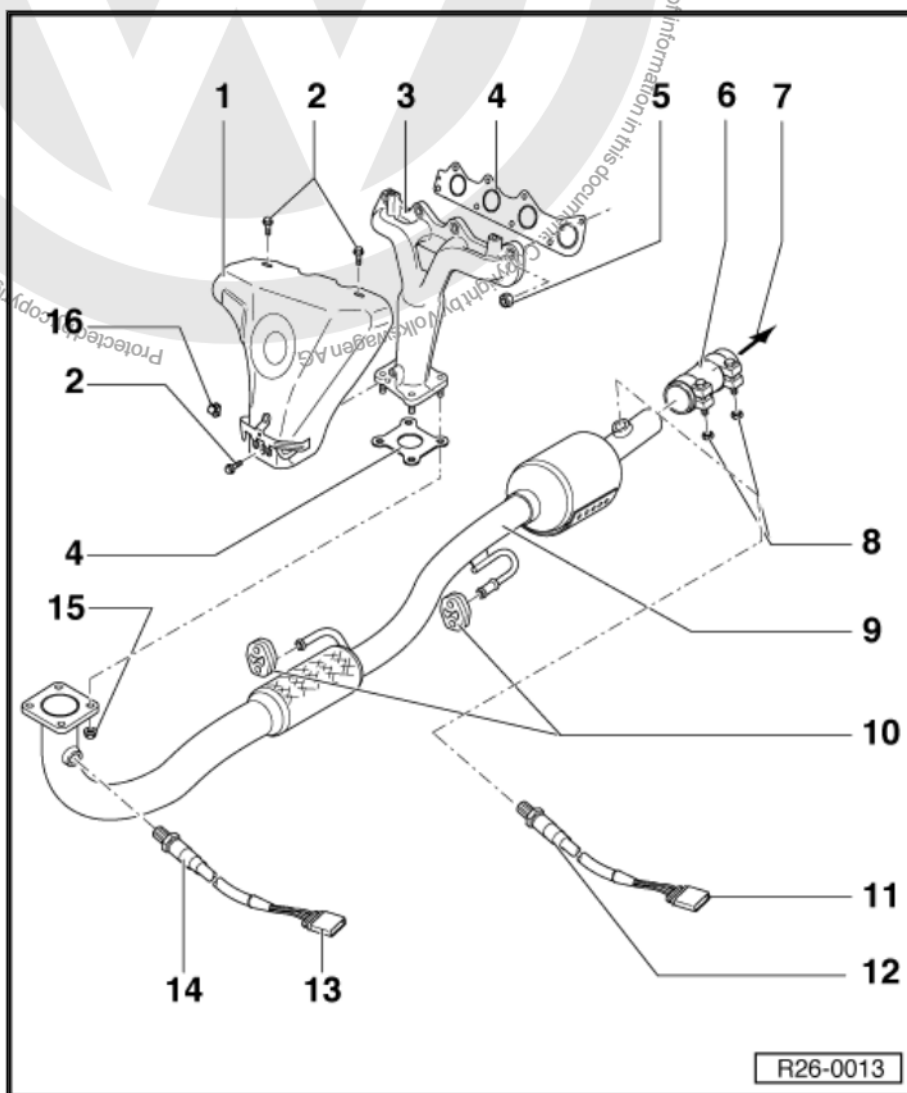


#### Note

- ◆ After completing installation jobs in the exhausting system, make sure the system is not stressed and that there is enough space in relation to body. If necessary, loosen double and retaining braces and align silencer and exhaust pipe so that there is always enough space in relation to body and brackets bear even loads.
- ◆ Self-locking nuts must be renewed.

#### 1.1 Exhaust collector, front pipe with catalyst and installation parts

- 1 - Heat deflector
- 2 - 10Nm
- 3 - Exhaust collector
- 4 - Sealing gasket
  - ☐ Renew.
- 5 - Safety nut, 25Nm
- 6 - Double clamp
- 7 - Until intermediate silencer
- 8 - 40Nm
- 9 - Front exhaust pipe with catalyst
- 10 - Holding bearing
  - ☐ Renew if damaged.
- 11 - Fitting connector
  - ☐ Black, 4-pin.
  - ☐ For lambda probe after catalyst -G39- and lambda probe heaters -Z19-.
- 12 - Lambda probe 2 after catalyst -G39-, 50 Nm
  - ☐ Lubricate only thread with "G 052 112 A3"; the "G 052 112 A3" must not come into contact with probe body slots.
  - ☐ Remove and install with key -3337-.
  - ☐ Remove sealing ring in case of leaks and renew it.



- 13 - Fitting connector
  - ☐ Black, 4-pin.

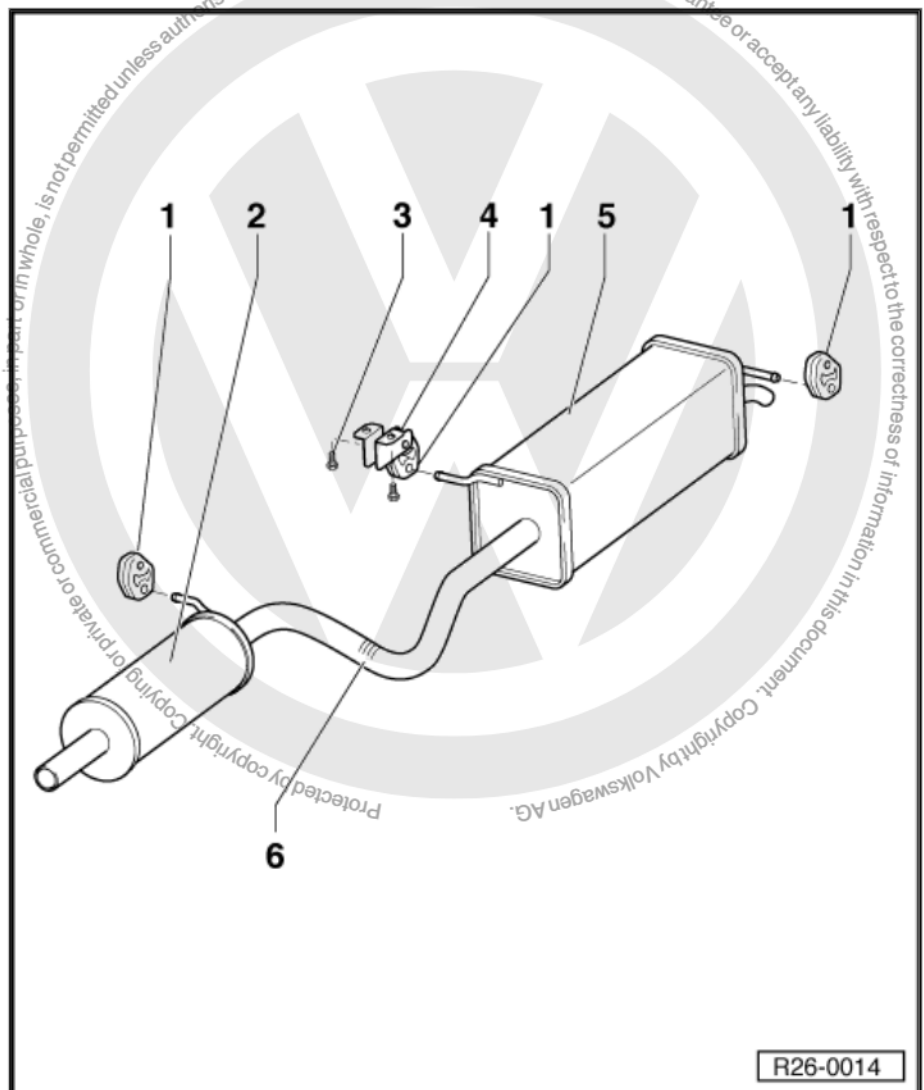




- ☐ For lambda probe before catalyst -G39- and lambda probe heaters -Z19- .
- 14 - Lambda probe 1 before catalyst -G39- , 50 Nm
  - ☐ Lubricate only thread with "G 052 112 A3"; the "G 052 112 A3" must not come into contact with probe body slots.
  - ☐ Remove and install with key -3337- .
  - ☐ Remove sealing ring in case of leaks and renew it.
- 15 - Safety nut, 40Nm
- 16 - Retaining clip
  - ☐ For electric cable.

## 1.2 Silencer with brackets

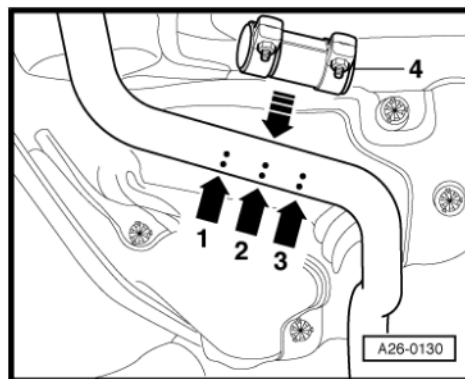
- 1 - Bearing
- 2 - Forward silencer
- 3 - 25Nm
- 4 - Bracket
  - ☐ Secured to body.
- 5 - Rear silencer
- 6 - Separation point
  - ☐ Identified per a recess or linking pipe.
  - ☐ Intermediate and rear silencer are assembled as single part. For repairs, intermediate silencer and rear silencer are separately provided, with double brace for repair.
  - ☐ Disconnect linking pipe on separation point with body saw, like - V.A.G 1523- , in a straight angle  
⇒ [page 132](#)





### Separation location on exhaust pipe

- Cut exhaust pipe in a straight angle on separation point -arrow 2-.
- Position repair double brace -4- during installation, on side identifications -arrows 1 and 3-. Tightening torque: 40Nm.





## 28 – Ignition system

### 1 Injection system - repair

#### 1.1 General indications on the ignition system

- ◆ This chapter addresses especially ignition system related components. Other injection and ignition system components ⇒ [page 108](#) .
- ◆ Minimum voltage of 11.5 V is necessary for the perfect operation of electric components.
- ◆ In some tests control unit may detect and memorise a fault. So, once all tests and repairs are finished, interrogate fault memory and delete if necessary ⇒ [page 128](#) .
- ◆ If after fault location, repair and component checking the engine works for a moment and dies out, the immobiliser may be blocking engine command unit. In this case, consult fault memory and, if necessary, adjust control unit ⇒ [page 128](#) ; Adjust components.

Safety precautions ⇒ [page 134](#) .

Spark plug checking data ⇒ [page 135](#) .

#### 1.2 Removing and installing injection system components



Note

*Motronic control unit - J220- with connectors  
⇒ [Item 7 \(page 109\)](#) .*

**1 - Connector**

- ☐ Black, 4 poles.
- ☐ For ignition transformer -N152-.

**2 - Ignition transformer -N152-**

- ☐ Installation location ⇒ [page 108](#), engine compartment overview.
- ☐ With codes for spark plug cables: A = cylinder 1. B = cylinder 3. C = cylinder 2. D = cylinder 4.

**3 - 10Nm****4 - Connector**

- ☐ Black, 2 poles.
- ☐ For knock sensor 1 - G61-.
- ☐ Gold plated sensor and connector contact.

**5 - Knock sensor 1 -G61-**

- ☐ Installation location ⇒ [page 108](#), engine compartment overview.
- ☐ Gold plated sensor and connector contact.

**6 - 20Nm**

- ☐ Tightening torque influences the operation of the knock sensor.

**7 - Connector**

- ☐ Black, 3 poles.
- ☐ For Hall sender -G40-.
- ☐ Connector contacts goldplated.

**8 - Hall sender -G40-**

- ☐ Installation location ⇒ [page 108](#), engine compartment overview.

**9 - Washer**

- ☐ Renew if damaged.

**10 - Spark plugs, 30Nm**

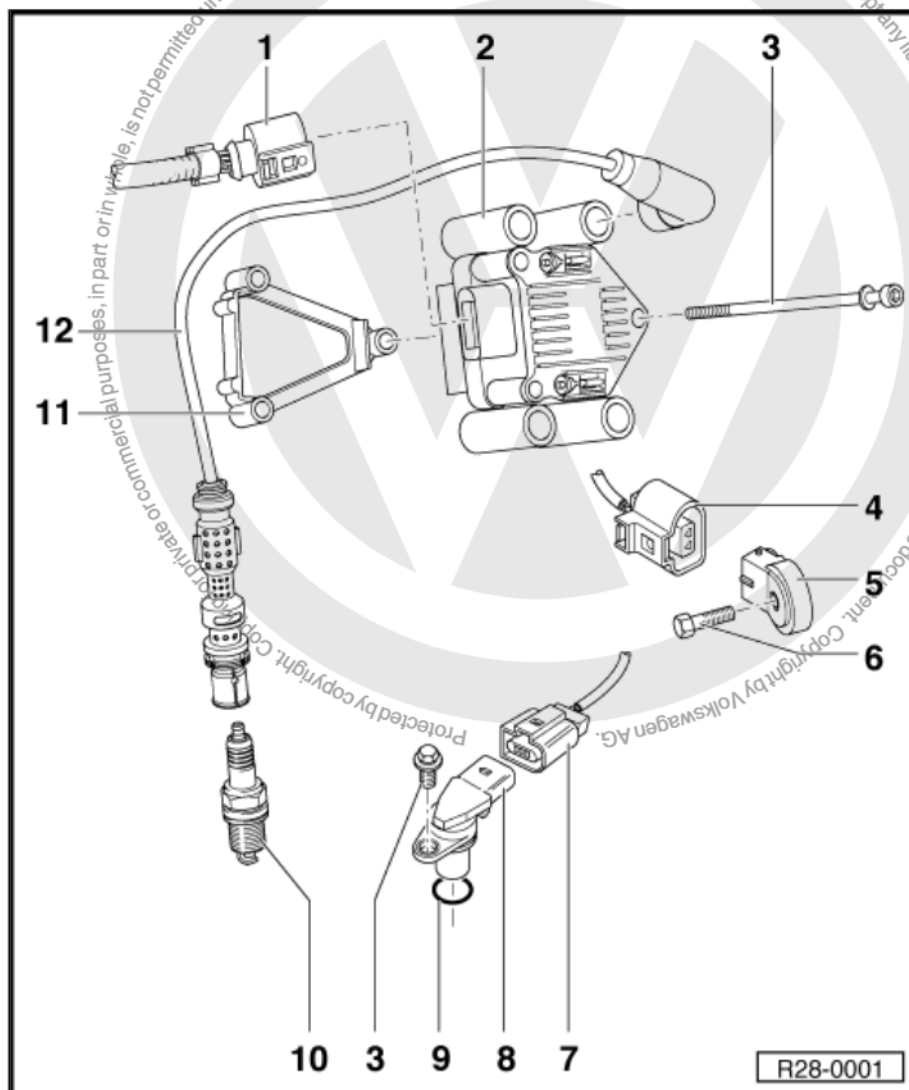
- ☐ Remove and install with spark plug wrench -3122 B-.
- ☐ Electrodes type and distance ⇒ [page 135](#), Test data, spark plugs.

**11 - Bracket**

- ☐ For ignition coil -N152-.

**12 - Spark plug connector**

- ☐ With interference eliminator and spark plug connector.
- ☐ Resistance 4.8...7.2kΩ.



### 1.3 Safety precautions

To avoid personal injury and/or injection and ignition system deterioration, observe the following:



- ◆ Do not touch ignition cables and do not disconnect them with engine running or in startup rotation.
- ◆ Loosen and connect injection and ignition system cables, including cables of measuring equipment, only with ignition off.

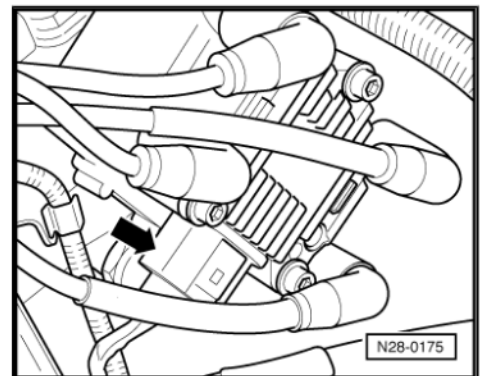
If during a test drive it is necessary to use test and measuring equipment, consider the following:

- ◆ Test and measuring equipment must be placed on the back seat to be used by a second mechanic.

If test and measuring equipment are operated on passenger seat, person seating there may be injured due to airbag activation in case of accident.

- ◆ If engine must be in starting rotation without really running:

- Disconnect 4-pole connector from ignition transformer -arrow-.

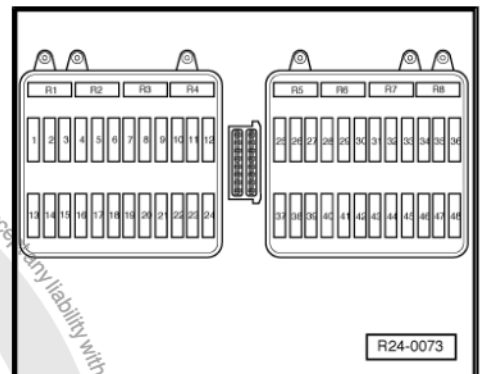


- Remove from fuse holder fuse number 33.



#### Note

When fuse 33 is removed, power supply to injectors is interrupted.



## 1.4 Test data, spark plugs

Engine identification letters	BLH
Ignition sequence	1-3-4-2
Spark plug <sup>13)</sup> , 2)	
VW	101905617/A/
Manufacturer's designation	NGK ZFR 6 P-G
Electrode gap	max. 1.0 ... 1.1mm
Tightening torque	30Nm

13) Current values and spark plugs renewal frequency: ⇒ Emissions Test Paste

14) Remove and install spark plugs with -3122 B-.

03.06